November-December 1980
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Number 6

Mariners Weather Log

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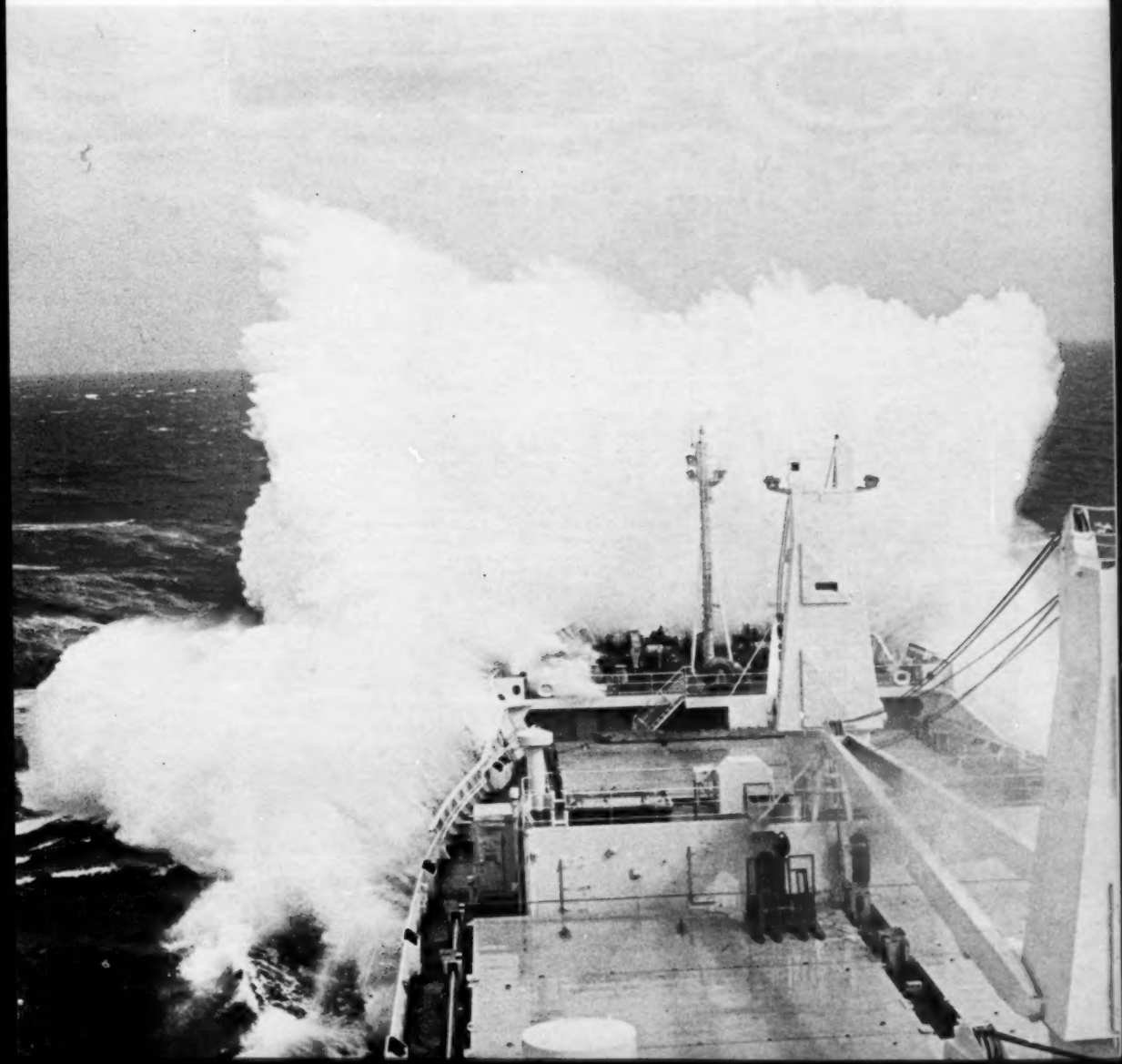

U.S. DEPARTMENT OF COMMERCE
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
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ENVIRONMENTAL DATA AND INFORMATION SERVICE.
Thomas D. Potter, Director

Front Cover: The 11,736-ton Swedish cargo vessel WINTER WATER takes green water on her bow from a heavy swell wave from tropical storm Georgette on July 28, 1980. The photograph was taken by 2nd officer Krister Brzezinski.

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1983.

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Mariners Weather Log

Editor: Elwyn E. Wilson
Editorial Assistant: Annette Farrall

November-December 1980
Volume 24 Number 6
Washington, D.C.

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Mariners Weather Log

DUTCH TUG SURVIVES NORTH ATLANTIC FURY

McDonald Harwood
Military Sealift Command
Washington, D.C.

Note: This article was published in SEALIFT Magazine of the Military Sealift Command, and it is reprinted with their kind permission and cooperation.

Sealift Editor's Note: Since man first began to navigate the rivers, bays, and oceans of the world, there has been a continuous battle to survive the often savage forces that can turn the calmest sea into a raging hell. It is not often that ships and the men who man them can win over a really angry ocean--perhaps never. But the Devil of the North Atlantic, as he is known to his contemporaries, may have come as close as anybody.

The Devil is in reality Captain Albert A.W. Christiaans, master of the 174-ft Dutch tug JACOB VAN HEEMSKERCK, which was chartered by Military Sealift Command to tow two 300-ft-long DeLong piers from Boston to Southampton, England, for the U.S. Army.

Between Boston and Southampton, tug and crew en-

Figure 1.--The Dutch tug JACOB VAN HEEMSKERCK is about to get underway for England towing two DeLong piers. On Christmas Day, gales turned into winds of hurricane force, and one of the piers was torn loose.

countered those savage forces that have sent many a good crew and well-built ship to the bottom of the ocean. During hurricane-force winds that began on Christmas Day, one of the piers broke loose, and for 5 days Christiaans chased it around the Atlantic in sometimes 50- and 60-ft seas. His crew was able to reconnect it, no mean feat in rough seas.

Figure 2.-- Boston workmen make a final inspection of the iron-beam shoring securing steel caissons on one of the piers.

Captain Christiaans decided to make emergency repairs in the Azores, and while there he and his crew volunteered to rescue a 6,000-ton merchant ship with an engineroom fire.

After rescue of the ship, and after repairs to the piers were complete, the VAN HEEMSKERCK again was headed for England only to encounter more high winds. At one point a message from the tug said, "Convoy stationary. Cancel ETA." (estimated time of arrival)

In spite of high winds and raging seas, the Devil of the North Atlantic managed to drive his convoy to Southampton earning a "well done" from MSC Commander Rear Admiral John D. Johnson who said:

"This [message] acknowledges your outstanding seamanship and perseverance in towing two DeLong piers from December 20 to February 12. You and your crew never failed to meet each challenge of this arduous voyage. Your skill and dedication in performing this service under such adverse conditions have materially contributed to the mission of this command and are clearly in the best tradition of mariners throughout the world. Thanks for a job well done."

The following story is an account of that voyage.

On December 20, 1978, folks around Boston, Mass., were looking forward to the coming holidays and the anticipation of sharing with families and old friends the

Figure 3.--Tug and tow head out of Boston harbor on a 54-day storm-tossed adventure.

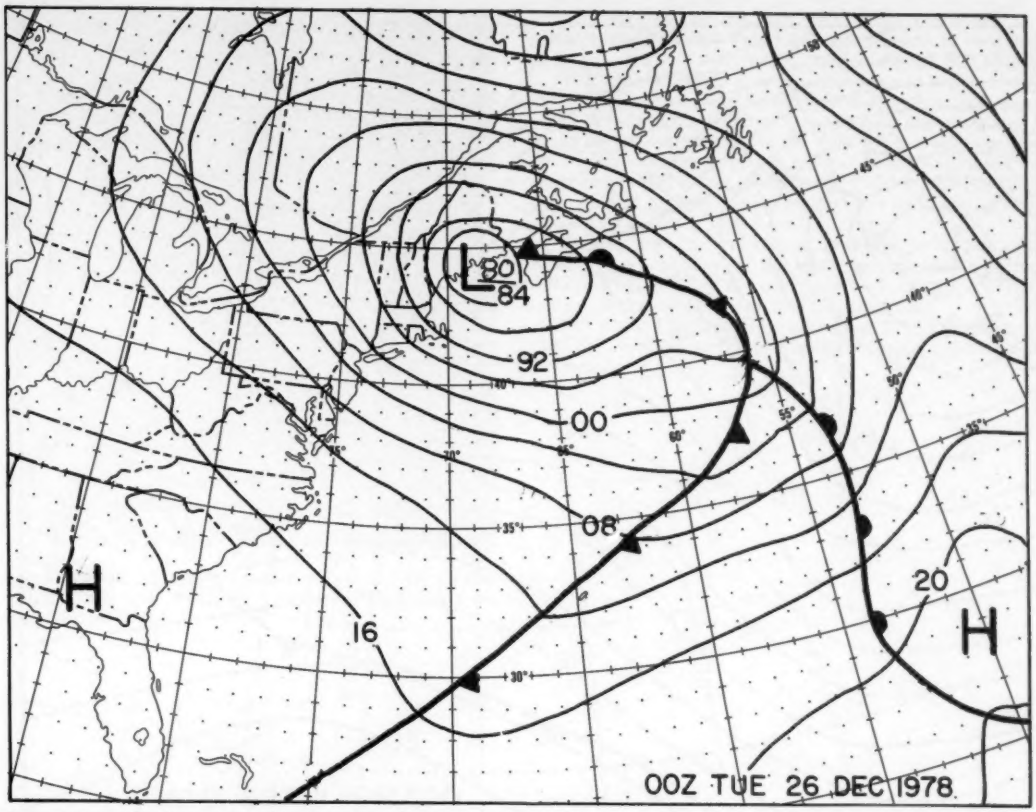

Figure 4.-- Weather map showing 980-mb coastal storm that raised havoc with the VAN HEEMSKERCK on Christmas Day.

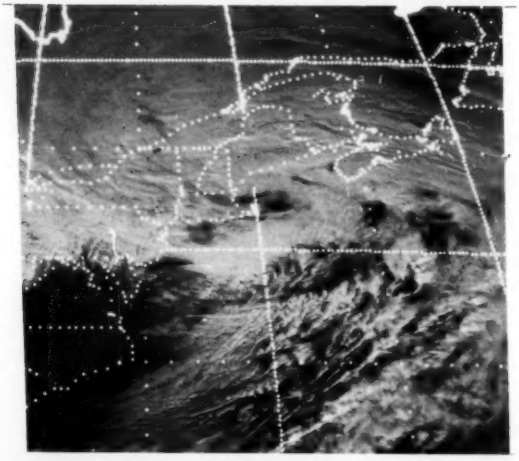

Figure 5.--Six hours earlier (1800 December 25) than the weather map GOES I snaps a picture of the storm off Cape Cod.

warmth and cheer of Christmas and the coming New Year.

On that same day, unknown to but a few dockworkers and shipyard personnel, the 174-ft seagoing tug, JACOB VAN HEEMSKERCK (fig. 1), headed through the icy waters of Boston Harbor towing two 300-ft DeLong pier sections destined for Hythe (Southampton), England, approximately 3,000 mi away (figs. 2 and 3).

The journey was to be filled with the excitement, frustration, and near disaster that is known only by those seafarers who brave the North Atlantic during winter.

The first few days out of Boston the VAN HEEMSKERCK encountered blustery weather typical of the northeastern coastal waters of the United States during winter. Then, on Christmas Eve, the weather began to worsen. On December 25 and 26 (figs. 4 and 5), with tug and tow engulfed in hurricane-force winds and 50- to 60-ft seas battering the VAN HEEMSKERCK, a towline parted, and the second barge was suddenly a captive of the raging storm.

Captain Albert A. W. Christiaans managed to keep radar contact with the stray barge, and 8 days later on January 2 the VAN HEEMSKERCK came within approximately 50 yd of the storm-tossed monster.

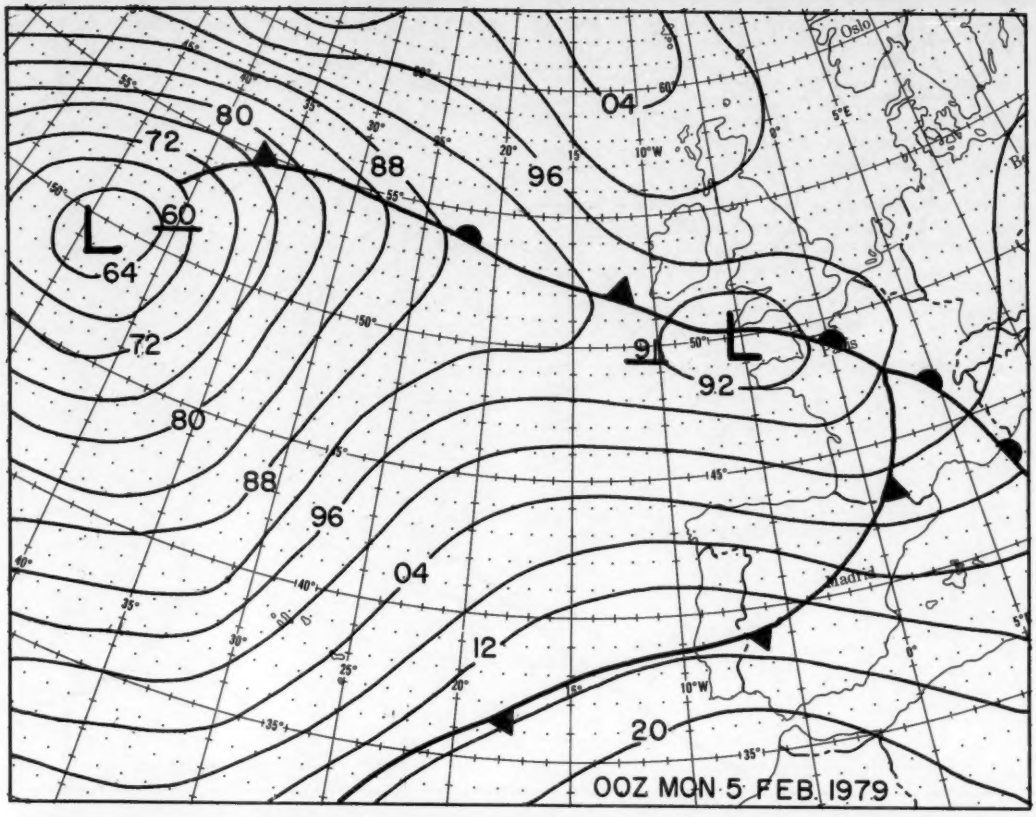

Figure 6.--VAN HEEMSKERCK's encounter with this system on February 5, 1979, delayed its arrival at Southampton, England. During the tow between the Azores and England, the barges sustained heavy damage.

The challenge that faced the crew was how to retrieve the tow with seas still running 30 to 40 ft. After much deliberation, it was decided that a man had to be put aboard the barge to assist in making up a new towline.

Since it was impossible for the tug to get alongside the heaving barge, Chief Mate Robert Deelder and Second Engineer Tjerk K. Tjeerde boarded a rubber liferaft and towed a small line over to the barge heaving it on deck. They boarded and then hauled an 8-in towing hauser aboard. After 2 hr of dangerous back-breaking work the hauser was secured to a boat cleat. The crewmen then inspected the 10 steel caissons which had been secured on deck with angle iron beams and welded brackets. They estimated that 70 percent of the welds were broken by the pounding of the storm.

Captain Christiaans decided to head for the port of Ponta Delgada in the Azores to put in for repairs. The Military Traffic Management Command Transportation Terminal Unit at Lajes Field was asked by the Military Sealift Command headquarters in Washington, D.C., to check on repair facilities in the Azorian archipelago. The chief of supply and maintenance for the terminal unit was appointed to check the various facilities in the Azores. He found that the port of Praia da Vitoria on the island of Terceira could handle the repairs with only a few logistics problems. Christiaans was informed and changed course for Praia.

Two Army tugs were called into service to help the Dutch crew bring the bulky piers into port.

The adventures of VAN HEEMSKERCK's crew were not over, however. On January 22, a small freighter approximately 200 mi north of the Azores reported an explosion and fire in the engineroom and said the ship was in serious trouble. The VAN HEEMSKERCK's crew responded without hesitation. Reaching the scene, they quickly rigged up a tow and the Singapore freighter ELIZA was taken to Ponta Delgada for repairs. The tug returned to Praia on January 26.

Four days later, in gentle seas and warm sunshine, the VAN HEEMSKERCK again was headed toward England, only to encounter more devastating winds and seas.

Moderate breezes gradually increased to gale proportions after 6 days (figs. 6 and 7), and the estimated time of arrival changed from February 11 to 13. In a

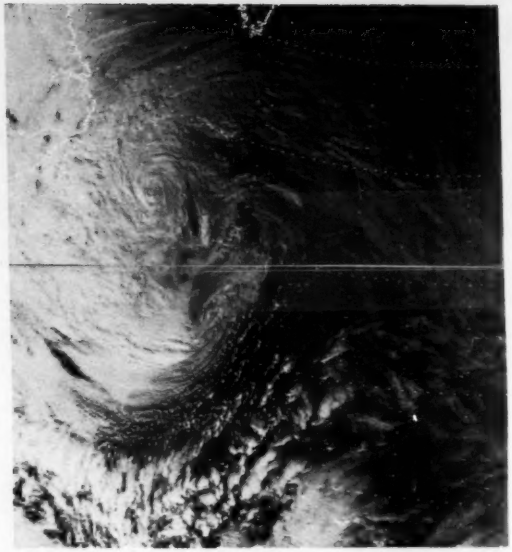

Figure 7.--Circulation encountered by the VAN HEEMSKERCK at 1600 February 4 extends all the way from Greenland to the Azores.

morning message on the 12th Christiaans reported, "Wind east-northeast Force 8 (fresh gale 39 to 46 miles an hour). Convoy stationary. Cancel ETA. Regards."

Weather conditions finally improved and the VAN HEEMSKERCK arrived Southampton at 9 a.m. on February 12--25 days overdue. The barges had sustained heavy damage during the battle with the sea between the Azores and England. About 2 dozen steel hull plates were crushed and torn on each pier. But, both piers were delivered even though tug and tow had taken some of Mother Nature's best shots.

The fact that the piers were delivered at all after absorbing the best punches the North Atlantic could deliver says a great deal for the stamina, seamanship, and dedication of Captain Christiaans and his crew.

The storms involved are described in the December 1978 and January and February 1979 Rough and Smooth Logs in the Mariners Weather Log.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM REGULARLY.

NEW DAILY OCEANOGRAPHIC ANALYSES

Steve Auer
National Meteorological Center, NOAA
Washington, D.C.

Real-time oceanographic analyses of the northwest Atlantic, the Gulf of Mexico, and the northeast Pacific are now available over the National Weather Facsimile Circuit (DIFAX and NAFAX). On May 28, 1980, the National Meteorological Center (NMC) began the daily transmission at 2157 of one oceanographic analysis per day. Six different analyses will be updated from one to three times each week to provide the maritime community with the latest available ocean frontal feature and temperature information.

Two analysis methods are used to generate the products. An oceanographic analysis, which is subjectively prepared, uses satellite imagery and sea-surface temperature (SST) measurements to generate the northeast Atlantic coast region and the southeast Atlantic coast and Gulf of Mexico region. An isotherm analysis, which is objectively prepared, uses SST reports to generate the western North Atlantic, Gulf of Mexico region, Gulf of Alaska region, and the U.S. Pacific coast region. Table 1 shows the weekly transmission schedule for these products.

A joint National Weather Service/National Environmental Satellite Service team of oceanographers manually prepares the oceanographic analysis. The analy-

Table 1.--NWS/NESS oceanographic analyses schedule for NAFAX and DIFAX

Time: 2157 (GMT)	
Monday	Oceanographic analysis, NE Atlantic coast
Tuesday	Oceanographic analysis, SE Atlantic coast and Gulf of Mexico
Wednesday	Oceanographic analysis, NE Atlantic coast
Thursday	Oceanographic analysis, SE Atlantic coast and Gulf of Mexico
Friday	Oceanographic analysis, NE Atlantic coast
Saturday	Sea surface temperature analysis, western North Atlantic and Gulf of Mexico
Sunday	Sea surface temperature analysis, Gulf of Alaska and U.S. Pacific coast

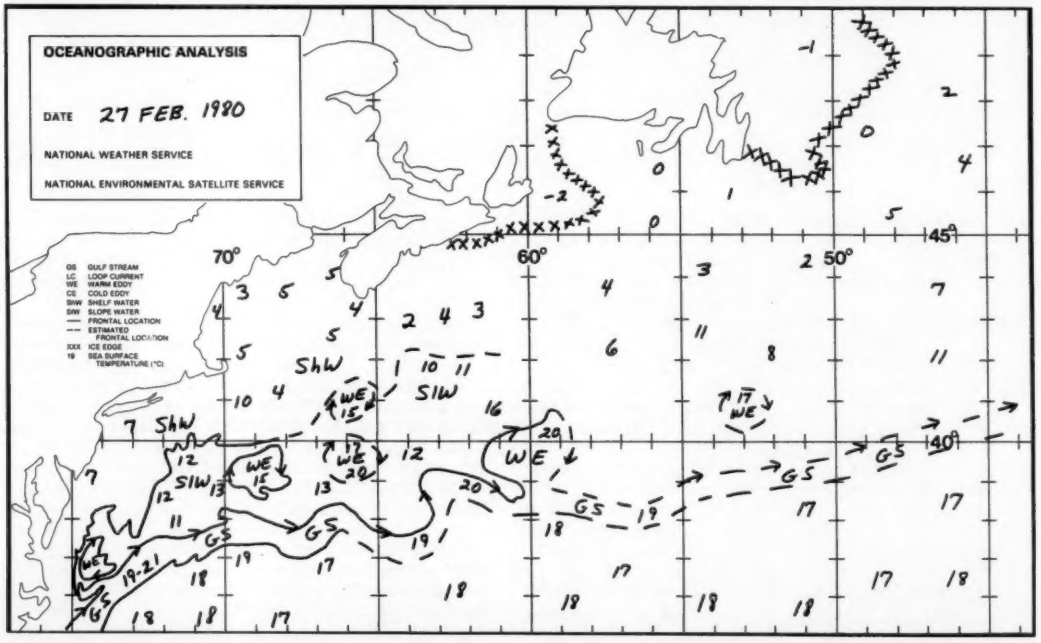

Figure 8.--Oceanographic analysis, northeast Atlantic coast. Solid lines are the observed ocean features, and dashed lines are the estimated features. Numbers show the SST in °C.

sis provides details on oceanographic features, such as the Gulf Stream, the Gulf Loop Current, the slope water/shelf water front, cyclonic and anticyclonic eddies, the subtropic convergence front, and the ice edge. The ocean features are principally found by using satellite imagery from NOAA's TIROS-N and NOAA-6 polar-orbiting satellites. The satellites provide 1-km resolution images using AVHRR (Advanced Very High Resolution Radiometer) infrared radiation-sensitive cameras. The images show the ocean features as thermal gradient contrasts in shades of gray--with darker shades indicating warmer water. A plastic latitude/longitude grid overlay is positioned over the image by using at least three identifiable land points. The identified ocean features are then drawn manually onto an analysis basemap. Many images are used to make the analysis. Several days of imagery are usually necessary to get good coverage of the region and to verify the existence and positions of the perceived ocean features. Difficulties in analyzing occur during cloudy weather, when the sea surface is obscured, and in late summer, when the SST contrasts are weak. Gridding problems occur when the land regions are obscured by clouds or the image is taken over an ocean region with no land points. Occasionally the GOES (Geostationary Orbiting Environmental Satellite) imagery is used, although it only has an 8-km resolution. However, the GOES is more likely to show a cloudfree area, because it provides an image every 1/2 hr, whereas the polar-orbiting satellites only provide two passes a day.

Representative SST are displayed in °C on the analysis to show the temperatures of various ocean features. SST are selected from a 5-day data base that includes readings from cooperating ships at sea, four reports a day from fixed and drifting data buoys, and expendable bathythermograph (XBT) reports from cooperating ships. These 5-day values are listed and then plotted onto a map by the NMC computer system. The analysis team can use the SST map to interpolate subjectively the positions of the frontal features when satellite coverage is poor. The XBT provide subsurface temperature readings in addition to SST, and are useful in determining water mass types.

The final oceanographic analysis map has solid lines drawn for the observed frontal features seen by recent satellite imagery and dashed lines drawn for the estimated frontal features. The water mass types and eddies are labeled in an abbreviated spelling. A legend on the maps aids the user. Figures 8 and 9 give examples of both regions.

The SST isotherm analysis is prepared twice weekly on the NMC computer system by the Ocean Services Group. The analysis uses the aforementioned SST data base to define a 25-km resolution grid.

The analysis basically involves a first guess of the temperature field, which is adjusted by the SST observations using a form of the Cressman Analysis technique. The first guess is taken from the previous analysis or from climatology. The observed temperatures are error-checked against the first guess, and those that differ from the first guess by more than a critical amount are deleted. The discard limit is variable, being a function of the horizontal gradients near each point. The first-guess field is then adjusted using the acceptable observations within a prescribed radius of influence (weighted by distance, not time) around each grid point.

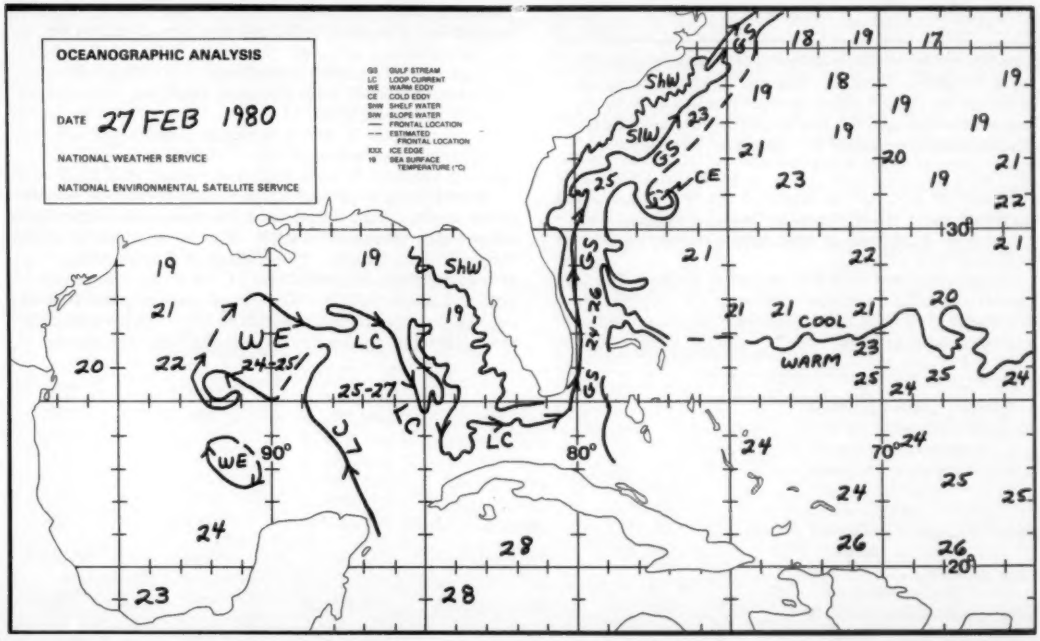

Figure 9.--Oceanographic analysis, southeast Atlantic coast and Gulf of Mexico. Solid lines are the observed ocean features, and dashed lines are the estimated features. Numbers show the SST in °C.

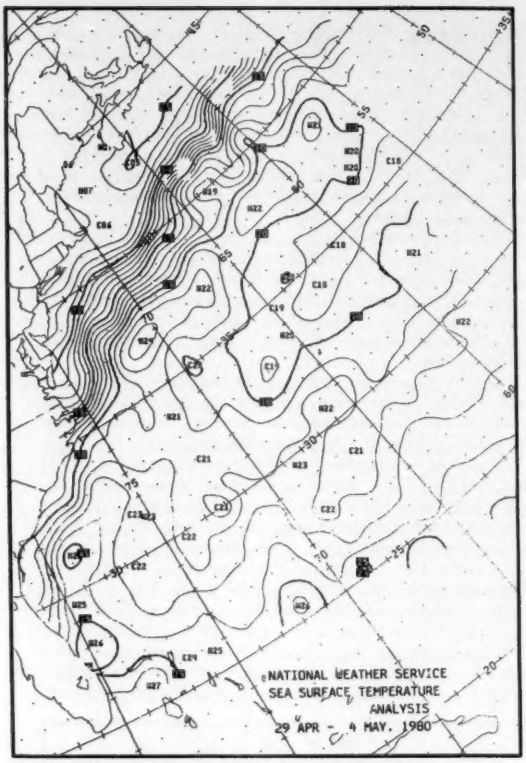

Figure 10.--Sea-surface temperature analysis, northwest Atlantic. Contour interval is 1°C. Areas of warmer or cooler water are marked with W or C, respectively, and the temperature. Dates indicate the period over which the data are composited.

The adjustment process is repeated several times using a decreased radii of influence and smaller discard limits. The final grid field is smoothed, and then contoured from a 50-km grid.

A Varian plotter draws the isotherm maps. The SST is contoured at 1°C intervals with each 5°C contour line emphasized. Areas of relatively warmer or cooler water are marked with a "W" or "C" and the corresponding temperature. For example, W28 indicates warm water at 28°C. The dates on the map indicate the period over which the data were accumulated. Figure 10 gives an example of the isotherm analysis map.

A weekly mailing of the oceanographic analyses charts is available to those who do not have access to facsimile. The cost is $12.50 per year. Write to:

Gulf Stream Analysis
Satellite Data Services Division
NOAA/EDIS/NCC
World Weather Building, Room 100
Washington, D.C. 20233

In addition, Marine Weather Radiotelephone Broadcasts on the rough location of the west wall of the Gulf Stream are transmitted daily by several stations along the U.S. East Coast. The station in Portsmouth, Va., also broadcasts the locations of the warm and cold eddies at 1600 and 2200. The broadcasts are updated by the oceanographic analyses three times per week. Table 2 lists the stations, frequencies, and times.

Table 2.--Daily marine weather radiotelephone broadcasts

Station	Call sign	Time (GMT)	Frequency* kHz SSB
Portsmouth, Va.	NMN	0400, 1000	4428.7
			6506.4
			8765.4
		1600, 2200	8765.4
			13113.2
			17307.3
Ocean Gate, N.J.	WOO	0100, 1300, 1900	4385.3
			4388.4
			8740.6
			8749.9
			13107.0
			13128.7
			17245.3
			17291.8
			22596.0
			22608.4
Miami, Fla.	NMA	0050, 1500	440

*Carrier frequencies

GREAT LAKES ICE SEASON, 1979-80

Daron Boyce
Great Lakes Ice Forecaster
National Weather Service, NOAA
Cleveland, Ohio

Unlike the previous three severe winters on the Great Lakes, temperatures were nearly normal during the 1979-80 Great Lakes Ice Season (tables 3 and 4). Ice generally formed late in the fall and melted earlier than usual in the spring.

The Sault Ste. Marie locks on the St. Mary's River system closed on January 15, 1980, bringing most of winter navigation to a planned halt. Shipping continued in the Straits of Mackinac through the winter, although at a minimal extent because of an economic downturn in both steel production and coal shipments. Shipping resumed on March 24, 1980. The main impetus for an early spring opening came from Canadian efforts to move grain from winter storage at the head of the Lakes to seaway ports. Coast Guard assistance to shipping was about half that of the previous season (table 5).

Table 3.--Departures from normal of Great Lakes air temperatures (°F) for the 1979-80 ice season

Month	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario	Overall
November	-0.1	0.5	-1.0	1.2	1.0	0.3
December	5.0	5.6	4.9	4.1	3.9	4.7
January	0.5	1.1	2.0	0	0.7	0.9
February	-1.0	-1.9	-1.5	-4.0	-4.3	-2.5
March	-2.1	-1.5	-0.1	-2.6	-1.0	-1.5
April	2.6	0.5	0.3	-1.1	1.1	0.7
Nov.-April	0.8	0.7	0.8	-0.4	0.2	0.4

Table 4.--Maximum accumulated freezing degree days (FDD) for the 1979-80 season and comparison to the previous three seasons and normal

Station	Maximum accumulated FDD				
	1979-80	1978-79	1977-78	1976-77	Normal
Duluth	2086	3045	2514	2641	2280
Marquette	1828	NA	NA	NA	NA
Sault Ste. Marie	1645	2212	2068	2325	1815
Green Bay	1211	2101	2033	2158	1423
Milwaukee	830	1447	1447	1575	900
Muskegon	694	1190	1197	1270	686
Alpena	1153	1591	1628	1684	1206
Detroit	623	946	1132	1129	NA
Toledo	643	974	1453	1363	852
Cleveland	570	709	999	1208	443
Buffalo	609	912	1098	1133	649
Rochester	738	925	987	1008	656

The FDD figure is obtained for each site by subtracting the mean temperature for the day from 32°F. Cumulative totals are compiled with negative daily figures (melting degree days) included.

FALL SEASON

The fall season on the Great Lakes was variable in character--perhaps typical--as the war between the remaining warm air masses of summer and the colder air masses of winter to come battled for control of the space over the midlatitudes. September was generally warmer than normal and much drier than usual for the Great Lakes. Some parts of Michigan received only a trace of rainfall for the whole month. Chicago and Milwaukee each received only .01 in of rain. Farther to the north, snow fell as early as September 8 in Sault Ste. Marie, Mich.

On the Lakes the recently commissioned boat INDIANA HARBOR loaded her first load of iron ore pellets (58,079 tons) at Two Harbors, Minn. By midmonth and her third trip, she loaded a record cargo for the port--62,653 gross tons. While American ships continued to ply the Lakes, many salties were anchored off Duluth-Superior Harbor awaiting a settlement of a strike which had prevented grain exports since July 6. The strike was settled in late September and 20 ships began sailing.

As October dawned on the Lakes a storm system moved through the area with heavy rains in the drought-

Table 5.--Summary of icebreaking assistance

Fiscal year	Direct assistance to industry (operation hours)	Cargo tons carried	Value of cargo carried	Number preventative icebreaking missions	Types of cargo
1971	4,080	2,520,152	$ 53,965,269		Cement, coal, general
1972	2,447	2,276,384	61,862,404		Grain, iron ore, limestone
1973	1,341	1,470,995	27,977,811		Petroleum, taconite, grain
1974	3,872	1,681,127	45,640,302		Steel, taconite, wood pulp
1975	2,575	3,662,653	10,933,614	177	Not available
1976	2,775	2,937,083	97,465,465	256	Not available
1977	5,942	4,556,724	125,142,602	47	Taconite, grain, petroleum, steel, coal
1978	6,863	9,507,274	98,982,105	98	Petroleum, taconite, grain, cement, steel
1979	3,990	4,359,953	147,720,000	216	Taconite, petroleum, grain, coal, chemicals, cement
1980	537	710,319 1,138,315 barrels*	81,855,299	313.9 hr	Taconite, petroleum, grain, coal, chemicals, cement

*petroleum products

stricken Midwest. Heavy fog shrouded some areas. On Lake Erie the Canadian boat FORT WILLIAM struck the Detroit River Light causing extensive damage to the Light and damage to her bow. Damage to the Light was estimated at $100,000. Major fall storms moved just to the west of the Lakes and up the U.S. East Coast during the month. They brought record early season snows to Minnesota and parts of Virginia to New England. On October 10 the JOHN J. BOLAND, loaded with coal, struck the breakwater at Ashtabula holing her bow. She required assistance from several local tugs and aborted her planned trip for Green Bay.

Late in October another major storm moved through the western lakes. The center passed Lake Michigan on the 23d, and blizzard conditions were reported around much of Lake Superior. Ten inches of snow fell on Houghton, Mich., and Marquette measured 45 mi/h winds and near-zero visibility. In the wake of the storm, which moved into Quebec on the 24th, the lower Great Lakes reported some lake-effect snows.

The chilly end to October did not last long into November--the traditional stormy month for the Great Lakes. Although record cold was gripping much of the western United States on Halloween, Muskegon, Mich., topped their high-temperature record with a reading of 73°F. By November 8 it was back into the deep freeze with snow and cold widespread over the Upper Lakes region. Alpena had a 15°F low, and 22°F at Muskegon was close to a record. The chilly weather persisted into midmonth. Western Pennsylvania chalked up 5 in of snow on the 15th.

On November 15 the National Weather Service issued their first freezeup outlook for the season, predicting earlier-than-normal ice on the northern portions of the Upper Lakes and generally near-normal ice formation elsewhere in the Lakes. The Detroit District of the Army Corps of Engineers announced that the Soo Locks would close within a week of January 8, depending on weather conditions. Demands for principal lakes' cargoes were soft, and it appeared that little winter navigation would be needed to meet them. Grain export traffic was still high, however, and Canadian shippers petitioned the Saint Lawrence Seaway Corporation to extend the closing date on the Seaway beyond mid-December.

The Coast Guard geared up for winter on the Lakes by commissioning their third new 140-ft multipurpose cutter MOBILE BAY on November 17. She was assigned to Sturgeon Bay, Wis., while two new ships commissioned earlier, the BRISTOL BAY and the KATMAI BAY, were assigned to Detroit and Sault Ste. Marie, Mich., respectively. The BISCAYNE BAY was added at St. Ignace, Mich., on December 8 (fig. 11).

Two storms of note were observed during the last half of November. The first formed in the central Rockies on the 19th and moved across the plains to Lake Superior on the 23d (fig. 12). Very strong winds whipped through much of the Great Lakes ahead of the storm. The Cleveland Cliff's-owned FRONTENAC with 27 crewmen on board was pushed into shoals near Silver Bay, Minn., during late evening on the 22d. Several holes were punched in her hull. With the help of the USCGC MESQUITE and several tugs she was hauled off the shoal about 5 hr after going aground.

The second storm was the result of high pressure over the Upper Lakes region. The flow ahead of the HIGH pushed Arctic air across the Lower Lakes into

Figure 11.-- The BRISTOL BAY smashes through heavy ice in operation "Open Buffalo" in the spring of 1980. U.S. Coast Guard Photo by PA 3 Mark Rudolph.

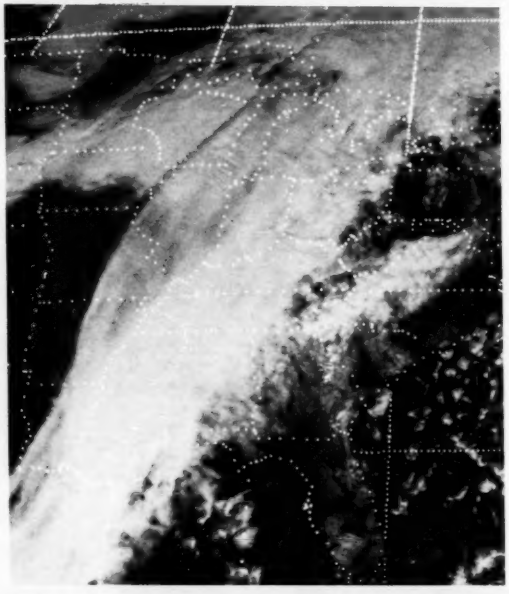

Figure 12.--The FRONTENAC was driven aground in Lake Superior during this storm.

Ohio, Pennsylvania, and New York. The usual lake-effect situation developed quickly, and snow bursts were common along the lee shores of Lake Erie. Twenty inches of snow buried Buffalo in less than 24 hr ending on December 2--the greatest 1-day fall since 1945. Up to 3 ft of snow were reported in rural areas in the region. On the 3d strong winds and high waves set the stage for a rescue on Lake Michigan. The 40-ft fishing tug SEABIRD was in danger of sinking after the waves broke her ribs and opened an 8-ft hole in her hull. Another laker, the BUFFALO, responded to calls for help and was able to shield the tug from the high waves and escort her to quieter waters in the lee of mainland bluffs near Sturgeon Bay.

During the remainder of December most storms in the central United States went north of the Great Lakes. This path permitted large southwest flows of warmer air to spread over the Great Lakes region. Temperatures for the month averaged 4° to 6°F above normal. Much of the snow which had fallen early in the month melted. However, on December 9 another quick shot of snow accumulated up to 1 ft deep in northern Michigan. On the 11th more warm air poured north, and the mercury reached 48°F at Alpena, Mich., for a new record, and readings in the 60's were common in Ohio. The warm air was replaced by colder Canadian air by the 16th. A strong cold front marched across the Lakes, and 5 in of new snow fell on Alpena.

Ice began to form in many of the shallows and bays of the upper Great Lakes in response to the early December cold outbreaks. Some grooming was required around dock areas in quieter harbors. In Superior harbor the A.H. FERBERT sustained $2,000 damage, when she nudged a loading dock due to ice accumulations. Nearby at the grain docks the last saltie of the season, the Liberian FEDERAL ST. CLAIR, was departing with 16,000 tons of grain.

At the other end of the Lakes system the St. Lawrence Seaway was counting down the last few days before their planned closing on December 18. Because of the heavy demand on grain exports, several ships did not clear the Seaway until the last few hours. As a result, eight ships each paid $80,000 in surcharges for late entry into the waterway. The Seaway finally closed on December 22. The FEDERAL ST. CLAIR was the last outbound ship, and the Canadian freighters LAKE WINNIPEG and MAPLECLIFFE HALL were the last boats through the American locks. The Greek vessel ARCHANGELOS spent the winter at Port Weller, Ontario, after running aground in the upper St. Lawrence with a load of scrap metal on December 16.

The first formal icebreaker assistance was rendered on December 19. The recently commissioned USCGC MOBILE BAY helped out the tanker JUPITER in Green Bay. As Christmas approached, many vessels had already been layed up for the winter. Only about 30 of the 140 Great Lakes vessels were operating during the last half of the month.

A weekend storm prior to Christmas was the storm of the month for the Lakes and much of the rest of the central United States. The storm moved inland from the Pacific on the 20th and reached southern Illinois on Christmas Eve. Considerable warm air was pulled north to the Lakes ahead of the storm. Chicago reported a new record high temperature of 62°F on Saturday the 22d. The warmth continued into Christmas Eve, when South Bend, Ind., chalked up a high of 58°F, beating their 1940 record by 4°. Gale warnings were posted throughout the Great Lakes, and the winds took their toll on the 24th (fig. 13). Mooring lines on the E.M. FORD in Milwaukee snapped in winds gusting well over 50 mi/h. She was slammed against the dock several times, heavily damaging her bow and port side. She was loaded with 7,000 tons of cement, and she finally settled to the bottom near Jones Island (fig. 14). In the wake of the storm, high winds on Lake Michigan caused severe flooding of shoreline areas in Chicago.

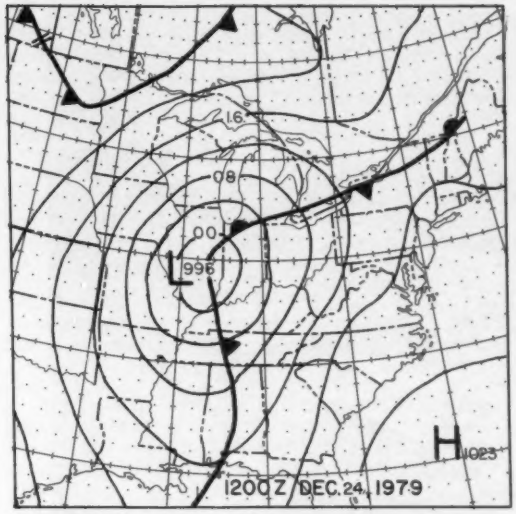

Figure 13.-- The big blow that raised havoc on the Great Lakes the day before Christmas.

The warmth persisted through the remainder of the calendar year. Temperatures averaged 9° to 12°F above normal through the holiday season. Ice continued to form in shallow bays around the Lakes. Saginaw Bay and the St. Mary's River were 50-percent covered at yearend, and Green Bay was 40-percent covered. Less than 10-percent ice coverage was reported in the open waters of the Lakes. The ice remained loose enough, however, for unrestricted navigation to continue. No direct or preventative icebreaking was required.

Although unrelated to the ice season, a major ship casualty occurred on December 29. American Steamship's NICOLET was severely damaged by fire, which raged aboard the ship for 21 hr after a spark from an acetylene torch ignited the conveyor belt of the self-unloader. The fire destroyed the pilot house and the officer's quarters as well as the related navigational and control equipment.

The Welland Canal closed their season on December 29. The last ships through the canal were the CANADOC downbound and the ALGOPORT upbound.

WINTER SEASON

The first few days of January had above-normal temperatures in the western two-thirds of the Lakes, but below-normal temperatures on Lakes Erie and Ontario. A major winter storm moved through the middle Atlantic States dumping heavy snows there,

Figure 14.-- The E.M. FORD lies partially submerged after winds snapped her mooring lines and the boat was pounded against the dock. Wide World Photo.

but no major weather systems affected the Lakes until January 6 and 7. A storm center developed rapidly in the Rockies on the 5th and moved to the Lakes by the 8th. Another center developed in the northern Rockies on the 9th and moved to Lake Superior. Up to 1 ft of snow was dumped on northern Michigan with the first storm along with high winds. Winds of nearly 70 kn pounded Duluth, Minn., blowing down the superstructure of Hallett Company's Dock No. 5. Damage was estimated at several million dollars.

Cold air which poured into the Great Lakes region behind the storms continued to build the ice cover. Green Bay was 90-percent frozen over as was Lake St. Clair. Ice over Saginaw Bay was 80-percent complete, while reports indicated that 35 percent of Lake Erie was ice covered. Side-looking Airborne Radar Flights (SLAR) during the week also indicated a 25-percent coverage in the Straits of Mackinac, 15 percent in Whitefish Bay, and about 10 percent in the open waters of the Lakes. The West Neebish Channel in St. Mary's River was closed on January 6 by the Coast Guard. Preventative icebreaking was underway in the River, the Mackinac Straits, and in Duluth Harbor. The Coast Guard activated their task forces under "Operation Taconite" in the Upper Lakes and "Coal Shovel" in the Lake Erie through southern Lake Huron region.

On January 10 the U.S. Steel boat EDWIN H. GOTT sustained $3,000 damage from ice in Lake Michigan. Traffic on the Lakes continued to dwindle, and only 20 boats were still operating by January 10.

"January thaw" weather highlighted midmonth. Temperatures averaged 12° to 15°F above normal the week of January 14 to 20. Houghton Lake in north-central Michigan posted a record high of 44°F during the period. Ice coverage remained nearly constant, and the last few transits on Lake Superior took place. The locks at Sault Ste. Marie were closed at midnight on January 15. This was the first closing of the Soo Canal since March 18, 1977. Fifty-eight boats used the locks in January this year.

The normal winter temperatures frequently allowed the ice cover to grow and decay over short periods of time. Unlike the previous recent winters, ice floes often broke loose from shore fast ice. This made the ice very dangerous for ice fishermen and other recreation-minded people. The Coast Guard rescued about 250 people from ice floes at a number of locations during the season (fig. 15). Even a deer was caught on a floe in the St. Mary's River during January. The KATMAI BAY crew assisted it to shore near Point Aux Frenes.

Figure 15.-- Fisherman on knees (left) waits on thin ice as Coast Guardsmen with ice skiff (right) cautiously approach. Photo by Todd Reed, Ludington Daily News.

The new Coast Guard 140-ft class tugs continued to provide much of the icebreaking assistance. The KATMAI BAY took credit for working with three boats in the St. Mary's River prior to the locks closing, and the BRISTOL BAY helped a tanker into Saginaw Bay.

Cold weather returned to the region during the last week in January. Following the closing of the Soo Canal, only 11 vessels continued to move. Ice expanded out from the shores of Whitefish Bay to cover 50 percent of the water, and the St. Mary's River was 95-percent frozen over. Ice coverage increased to 35 percent in the Straits of Mackinac, and two tankers, the JUPITER and the AMOCO WISCONSIN,were helped out by the cutter BISCAYNE BAY.

Snowfall was notably absent from most of the northeastern United States during the month. This was true for the Lower Lakes region also, but the Upper Lakes recorded nearly normal amounts of snow. Around 3 in of snow fell on portions of Minnesota, Wisconsin, and western lower Michigan on the 24th. On Lake Michigan the same day, the tanker JUPITER sustained $3,500 damage in ice.

Colder weather again caused significant ice expansion, so by monthend coverage was 85 percent on Lake Erie, 70 percent on Lake St. Clair, 95 percent in Saginaw Bay, 50 percent on Lake Huron, 85 percent in the Straits of Mackinac, and 100 percent on the St. Mary's River, Whitefish Bay, and Green Bay. Only six lakers were operating on the Lakes, so icebreaking was at a minimum. Assistance was given to oil tankers, barges and to ferries which operate year-round in the Straits.

As February dawned over the Lakes, cold weather was the rule, and it continued through the first half of the month. Readings began about 10°F below normal and moderated only 2° to 3°F by midmonth. A snow storm left a fresh 7 in fall on Milwaukee on the 3d, and typical lighter dustings occurred elsewhere. Northern Ohio stations reported 5 in of new snow at midmonth, and the temperature at Chicago dipped to -5°F on the 17th--the coldest of the season to that point.

Icebreaker assistance was minimal during the early half of February because of the small number of ships operating. Direct assistance still was rendered mainly to tugs, tankers, and barges. The cold weather created considerable new ice. By midmonth the ice cover in percent had increased to 95 on Lake Erie, 80 on Lake Huron, 70 on Lake Superior, 95 in the Straits of Mackinac, and 35 on Lake Michigan. On Lake Erie the increased ice cover in the central basin was restricting the outflow of several rivers from northern Ohio, and flood-relief icebreaking was conducted on the 11th and 12th.

Warm weather pushed into the Great Lakes during the third week in February. Rain rather than snow was the rule in most areas. Flood-relief icebreaking was needed again along the Ohio shores of Lake Erie. The thaw was short-lived, however, for the coldest weather of the winter season spread over the region during the last part of the month (fig. 16). Temperatures fell below zero in all but the southernmost sections. A frigid blast of Arctic air was accompanied by considerable snow. Two to five inches were reported in Milwaukee near monthend. On March 2, as a snow storm which had marched up the East Coast was dying out, the temperature fell to -15°F at Syracuse, N.Y. It was only 1 of nearly 50 records set on

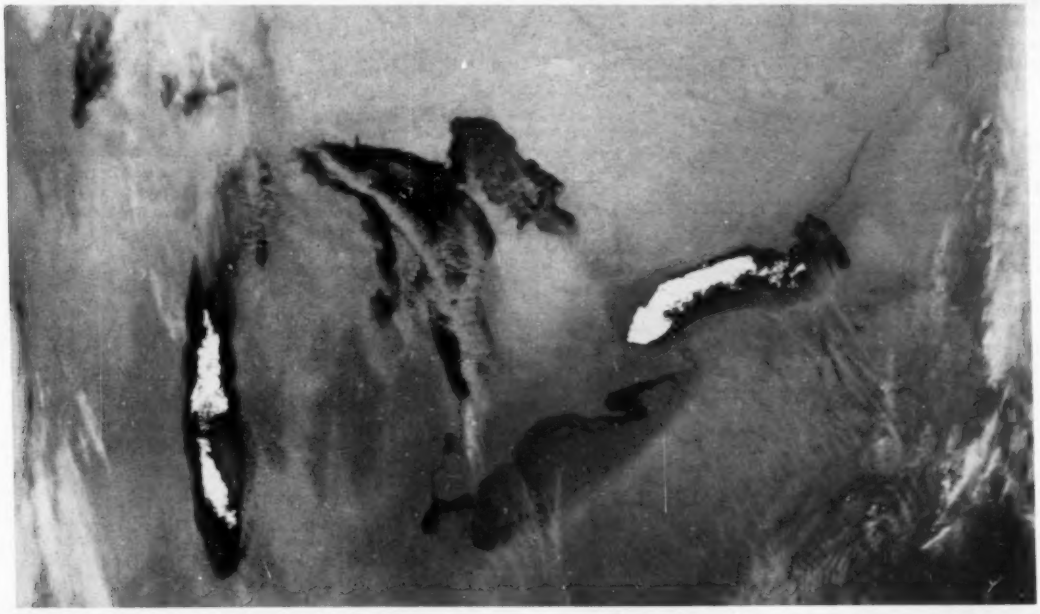

Figure 16.-- Although relatively light compared to the previous two seasons, ice coverage reached its peak near the end of February.

Figure 17.--Frigid blast of cold air silhouettes the Coast Guard cutter BRAMBLE in sea smoke on the St. Clair River. Times Herald, Port Huron Photo by Rick Scheuerman.

that morning.

By the end of February lake traffic decreased to the low point for the ice season--four boats. The Coast Guard recorded only 19 vessel assists for February.

SPRING OPENING

The first week of March brought the first decrease in seasonal ice coverage on the Lakes and an increase in shipping activity. Temperatures still remained cold, but early spring sunshine eroded some of the ice cover. At the peak of the season in February, ice thicknesses ranged from generally 8 in or less in the Lower Lakes and connecting channels to 18 in in portions of the St. Mary's River, Whitefish Bay, and Saginaw and Green Bays.

Frigid weather was dominant in early March (fig. 17), but temperatures began to pull back to normal by the middle of the month. On March 12 Sault Ste. Marie tallied a new record low of -13°F. In spite of the lingering winter, weather plans for early spring shipping were being formulated. The St. Lawrence Seaway announced they would open on March 24. This record early date was a consequence of a large backlog of grain shipments. Storage of grain on board Canadian vessels over the winter was over 17 million bushels on 41 ships in both United States and Canadian ports. The backlog in Lake Superior ports was not expected to be eased, however, because the Corps of Engineers announced they did not plan to open the Soo Canal to traffic until April 1. They gave in to the mounting pressure later in the month and opened at the same time as the Seaway.

Almost on cue for the spring opening, milder weather arrived in the Lakes during mid-March (fig. 18). Winter did not give up easily, however, Five inches of snow fell on Buffalo on March 22. A 52°F temperature in Cleveland plunged to 38°F in 20 min, and winds of nearly 60 kn slashed through the area the same day.

Shipping picked up on the Lower Lakes in early March, but interest in trips to the lakehead remained low through the month. The coal shuttle from Toledo to Detroit began on March 3 with the arrival of the HENRY FORD II. The S.T. CRAPO started the season for Huron Cement, leaving Alpena on March 20. The first iron ore cargo of the season came from Marquette on March 22 aboard the Canadian FRONTENAC. The ALGOBAY and the FRONTENAC were the first vessels to be assisted in Whitefish Bay during the spring. They were helped along by the USCGC MACKINAW. The J. B. FORD was the first boat through the Straits on a spring run. Occasional traffic had moved through the area all winter with the help of the BISCAYNE BAY and the MACKINAW.

At the eastern end of the Lakes system Canada Steamship took the honors for the first vessels through the Welland Canal. For the second year in a row the H. M. GRIFFITH took the top hat for the first upbound ship, while her sistership the TADOUSSAC was the first downbound. On the St. Lawrence Seaway, the CANADIAN OLYMPIC was the first downbound vessel and the British WELSH VOYAGER was first upbound. The Greek ship ARCHANGELOS, which wintered on the Lakes because of her grounding in December, passed down the Seaway shortly after the opening.

Rain and milder weather melted considerable ice in the Lower Lakes region during the last week of March.

Figure 18.--By March 19 ice conditions on the Lakes had eased; only Lake Erie and some of the straits and bays still had some coverage.

Lake Erie's coverage decreased from 75 to 30 percent, Lake St. Clair from 60 to 10 percent, Saginaw Bay from 95 to 65 percent, and the Detroit and St. Clair Rivers became ice free. Lake Michigan in general had a very light ice season. The Coast Guard's Operation "Oil Can" was only in effect for 20 days from March 11 to 31. The USCGC ACACIA was kept busy during the last week of March breaking ice, so local area fishing fleets could reach the open lake for the summer season. On the 24th she worked in Muskegon Lake and Lake Macatawa in Michigan. The cutter SUNDEW conducted similar operations farther north in the lake around Beaver Island and St. James Harbor. Over the Lakes nearly 50 boats were directly assisted during March.

Typical spring weather with wide variations in temperatures and occasional rain or snow was observed during April. Milder weather was the rule during the first week, but winter left a late-season mark on April 4 with 6 in of snow on Alpena, Mich. A clash of weather systems on the 8th resulted in a large outbreak of severe weather in the Midwest. Nearly 3 dozen tornadoes were reported, 13 of them in Ohio. An inch of rain soaked Muskegon, Mich. Rain and warm weather rapidly destroyed the ice cover, and icebreaking requests to the Coast Guard decreased.

During the first 6 days of April the MACKINAW, KATMAI BAY, and SUNDEW were kept busy helping 45 boats from Whitefish Bay through the St. Mary's River system and the Straits of Mackinac to either Lake Michigan or Lake Huron. Many were grain-laden Canadian vessels. The PHILIP R. CLARKE was one of the few U.S. Fleet boats moving iron ore pellets. The WILLIAM P. SNYDER reported $120,000 in ice damage after a run through the Straits of Mackinac on April 5. No assists were logged by the Coast Guard between the 7th and 15th.

A brief cold spell and snow storm spread from the Ohio Valley into Michigan on April 14, and a flurry of icebreaking followed on the 16th and 17th. The main problem area was the St. Mary's River again, and the KATMAI BAY took all nine assignments those 2 days.

No better example of the fickleness of April could be found than the weather from Tuesday April 22 through Thursday the 24th. Early in the week a dry air mass baked the Midwest with unprecedented heat. Chicago warmed to 91°F; and Madison, Wis., soared to 94°F--12° above the former record for the date. A new maximum record of 88°F was recorded the following day in Marquette. A cold front slashed through the Lakes overnight, however, and on Thursday 1 to 3 in of snow whitened Milwaukee, Muskegon, and Grand Rapids. Muskegon's temperature fell to 27°F and Alpena's to 24°F--both new low records for the date.

In spite of the snow and cold, the heat wave had done its work, and the Great Lakes ice cover was diminished to only a few back bays and coves in the northern lakes. The USCGC MESQUITE took honors for the last recorded icebreaking for the season. She worked in Ashland, Wis., harbor on April 21.

SUMMARY

For the first time in 3 yr the Great Lakes region had a nearly normal winter season. Temperatures as a whole were less than 1/2 degree above normal. The transition months of November and April varied from lake to lake, but the core months of December through March were unusually consistent over the whole region, either warm or cold. February showed the greatest departure from normal on the cold side, but December showed an even greater departure in the other direction (warm).

The freezing-degree-day (FDD) accumulations for this season also show the normality of the year compared to previous winters. Cleveland, Toledo, and Rochester all reported slightly higher-than-normal FDDs, indicating a colder-than-normal winter, which also shows in the departure statistics for the same area.

Economic demands for typical Great Lakes commodities such as iron ore, coal, and energy were well below the previous seasons, and shipping activity decreased proportionately. For the first time in almost 3 yr the locks at Sault Ste. Marie, Mich., were officially closed. Export demands for grain were at an all-time high, however; so great in fact that several shippers were forced to pay operational penalties for movement through the St. Lawrence Seaway system after the announced closing date. The same high demands in the spring forced a record early opening of the outbound system from the Lakes to the Atlantic.

Icebreaking statistics supplied by the Ninth Coast Guard District also reflected the more normal winter season and the decreased shipping activity. Damage to Coast Guard vessels was minimal for the first time in recent memory. This can be attributed partially to the use of the new fleet of 140-ft Coast Guard cutters, which outperformed their designed icebreaking capabilities in almost all areas. The number of ship operational hours devoted to direct industry assistance was only 537.1 hr--the lowest on record since formal extended seasons began in 1971-72.

ACKNOWLEDGMENTS

Icebreaking data and casualty data were supplied by the Ninth Coast Guard District, Cleveland, Ohio. Ice information was derived from records of the National Weather Service Forecast Office, Ann Arbor, Mich., and the National Weather Service-Coast Guard Ice Navigation Center, Cleveland, Ohio. Other navigational information was taken from Lake Log Chips, published by the Center for Archival Collections at Bowling Green, Ohio.

Hints to the Observer

SHIP REPORTS NEAR COASTS

Many storms have their origin or greatly intensify just off the coasts of land masses. Weather reports from ships near coasts are important, and sometimes more important than reports of the weather farther at sea. It is vital to know of the existence and character of storms along the coasts, for forecasting how and when they might affect land areas, especially built-up coastal areas, including ports and coastal shipping. The increasing importance of the Continental Shelf adds emphasis to this need. Meteorological and oceanographic data are vital to the utilization of this area. The same data are also vital for search and rescue efforts.

Weather forecasting is extremely dependent on knowing the current weather. In general, the forecasts can be no better than the weather observations. Ship reports are one of our most important sources of information for vast areas where there are no other reliable and accurate sources for measuring the surface weather conditions.

Meteorological satellites are providing important information, with detail and data continually improving, but they cannot replace good measurements of pressure and pressure changes, air and sea temperatures, sea conditions, and pertinent remarks provided by ship reports. Buoys are being deployed and appear to have great potential, but it will probably be many years before their coverage can compare with the number of ship reports available.

The placement of buoys is a good example of the importance of near shore observations since historically storms form or intensify near shore.

We urgently need your ship observations. To help us do a better job, we ask that weather reports be made and transmitted whenever possible without regard to proximity to land. The newly instituted voice frequencies make it easier than ever to submit your observations.

Tips to the Radio Officer

Tom Reppert
National Weather Service, NOAA
Silver Spring, Md.

On October 1, 1980, the U.S. Navy transferred responsibility for the Atlantic High Seas CW weather broadcast to the Coast Guard Communications Station NMN, Portsmouth, Va. The broadcast will be keyed as before from Norfolk, Va., and simulcast from Key West, Fla.; Reykjavik, Iceland; Thurso, Scotland; Rota, Spain; and Athens, Greece. Broadcast schedules and frequencies are unchanged. Comments concerning this broadcast may be addressed to the NMN operator via AMVER frequencies or to the Commandant, U.S. Coast Guard, GOTM, Washington, D.C. 20590.

Also on October 1, 1980, the Navy closed the Public Coast Radio Station at NAVCOMMSTA, NBA, Balboa. Commercial communications services can be provided by Canal Radio, HPN-60. Canal Radio operates on the following schedule:

Frequency		
500	calling	H24
438	working	H24
4240	working	9Z-11Z
6467	working	01Z-11Z
8607	working	H24
12873.5	working	H24
17128.5	working	11Z-01Z
22412	working	11Z-01Z

The Navy announcement closed with, "The Public Coast Radio Station at NAVCOMMSTA, Balboa, has been proud to serve the Panama Canal and the ships of the world since 1914. With our heads held high, we will remove our fingers from the CW keys and say farewell to our shipmates on the high seas."

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (JUNE 1980 EDITION)

Page 22
1-1130 Manila, Philippines DZG
Delete times; insert 0300, 1500 with note "Immediately following the traffic list."

Page 40
2-0250 Shinnecock, NY NMY-41
Delete times; insert 0020, 1220. Delete footnote 2.

Page 41
2-0270 Cape May, NJ NMK
Delete times; insert 0020, 1220.

Page 42
2-0380 Miami Beach, FL NCF
Delete times and frequency; insert 1230, 2230 157.1 MHz.

Page 43
Insert new station:
2-0415 Panama City, FL NOQ-7

Area:[1] Coastal waters, Tarpon Springs to Biloxi.		
1000, 1200 1600, 2200	2670	F
1035, 1635, 2235	157.1 MHz(F3)	F
On receipt	do.	W

Insert new station:

2-0425 Mobile, AL		NOQ
Area:[1] Coastal waters, Tarpon Springs to Morgan City.		
1020, 1220, 1620, 2220	2670 157.1 MHz(F3)	F
On receipt	do.	W

Insert new station:

2-0446 Berwick, LA		NMG1
Area:[1] Coastal waters, Apalachicola to Port O'Connor.		
1000, 1600, 2200	157.1 MHz	F
On receipt	do.	W

2-0450 Galveston, TX		NOY
Add frequency 157.1 MHz.		

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2-1160 San Francisco, CA		NMC
1630, 1900, 2330	157.1 MHz	F

[1]See figure 3.

Page 53

2-1230 Kodiak, AK		NOJ
Delete times and frequencies; insert:		
0200, 1645	6506.4	F
0030, 0230, 0530, 1300, 1600, 1800	157.1 MHz(F3)	F

2-1250 Ocean Cape, AK		NMJ-19
Delete station.		
2-1261 Juneau, AK		NMJ-1
Delete times and frequencies; insert:		
0203, 0303, 0403, 1403, 1503, 1603	157.1 MHz(F3)	

Page 55

2-1470 Humboldt Bay, CA		NMC-11
Add:		
0333, 1503	2670	F

Page 56

2-1481 Monterey, CA		NMC-6
Add:		
0333, 1533	2670	F

Page 85

Add to list of NOAA Weather Radio stations:

Toledo, OH	162.55
Syracuse, NY	162.55

ACKNOWLEDGMENTS

Thanks to Lyman G. Hailey, RO, SS WORTH, and John Vallis.

Hurricane Alley

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D.C.

SHIPPING AND HURRICANE ALLEN

In the last issue the National Hurricane Center kindly provided a meteorological summary of hurricane Allen. The havoc wreaked by Allen throughout the Caribbean prompted us to provide a brief preiiminary summary of the damage to shipping.

While Allen's presence was felt for about 9 days in the Caribbean and Gulf of Mexico, his memory lingers on. From Barbados to Corpus Christi, from the 3d through the 11th, his wake was strewn with grounded ships, capsized oil rigs, and wrecked ports. Allen played no favorites--a wooden schooner, luxury yachts, several oil rigs--they all fell victim to the fury of the storm.

By early Sunday morning August 3 Barbados and Trinidad had already issued gale warnings and a hurricane watch for the southern Leeward and northern Windward islands. That night they felt the brunt of the rapidly building hurricane. St. Lucia, particularly the south coast, was the hardest hit. Preliminary figures indicate 18 deaths and hundreds of people left homeless. Crop damage, particularly the banana crop, was severe. The port and capital of St. Lucia, Castries, was battered. The wood schooner BUCCANEER, which was moored to the main jetty, broke its lines and was driven aground. The SEA HORSE, a catamaran, came ashore 30 ft astern of the BUCCANEER. The Venezuelan naval training vessel AMAZONAS was also driven aground on the south side of the harbor. Numerous other yachts and vessels suffered minor contact damage. The SEA HORSE eventually was lifted out by a crane barge, while the AMAZONAS was quickly refloated. The JORGE H. dragged her anchors and suffered damage to her port rudder. Massive power outages led to a closing of the port to evening traffic for a time.

Near Barbados the CURRENT TRADER and the BEN VEG were driven aground just outside Bridgetown Harbor. Both were eventually refloated. In the harbor (fig. 19) some 20 small fishing boats were destroyed and another 75 damaged. At St. Kitts waves up to 25 ft washed several barges ashore, badly damaged a warehouse, and flooded some houses. Southeast of Basseterre, a new deepwater port still under construction

Figure 19.--Fishing boats and the remains of fishing boats pack Bridgetown Harbor, Barbados, after the storm. Wide World Photo.

Figure 20.--Coming home after Allen ravaged this village on the south coast of Haiti. Wide World Photo.

suffered extensive damage. Elsewhere, one death was reported on Guadeloupe.

Passing south of the Dominican Republic and close to Haiti, Allen spread strong winds and torrential rains along the island's south coast. Hardest hit was Haiti's southwest coast on the 6th (fig. 20). An estimated 220 people were killed, and some 835,000 were left homeless. Flash floods were the major reason. They also destroyed about one half the nation's coffee crop; total damage was estimated at more than $400 million.

Earlier, on the 5th, the GEORGIOS, sailing about 200 mi southeast of Kingston, Jamaica, radioed a course change to avoid Allen. The 7,223-ton cargo vessel was bound for Belize from Santo Domingo. After the vessel was considered missing, a Coast Guard search turned up an empty lifeboat with the ship's former name. There were 27 people on board.

Allen brought his 145-kn winds and torrential rains to eastern Jamaica early on the 7th. The banana crop was particularly hard hit. Trees and powerlines littered roads. Torrential rains triggered extensive flood-

Figure 21.--Safe aground lies the Liberian tanker MARY ELLEN some 12 mi south of Port Aransas on the 11th. Wide World Photo.

Figure 22.--This was an unscheduled outing for a cabin cruiser and many other small boats at the Corpus Christi Marina. Wide World Photo.

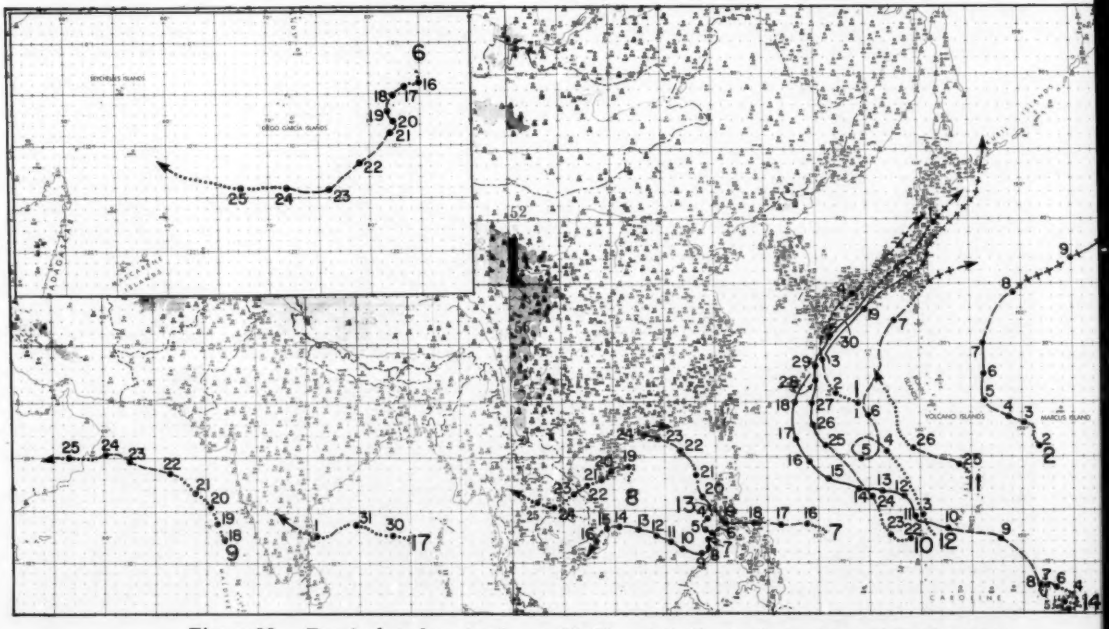


Figure 23.--Tropical cyclone tracks worldwide originating in September and October 1979.

ing. The Outrum River in Port Maria overflowed its banks, and floodwaters in the town were 5 to 6 ft deep. Damage was estimated in the millions of dollars. Much of Cuba was spared, but at Nuevitas the GOOD TRANSPORTER, a Greek cargo vessel, was driven aground. On Grand Cayman the 560-ton MIK TRADER and an American yacht DREAMERS DREAM both broke anchorage and grounded. The yacht then broke up and washed ashore. Alongside the marina at Cayman Cai Developments, the ferry NOA capsized and sank.

As Allen approached the U.S. coast oil rigs were evacuated and ships sought shelter. During these evacuations an oil company helicopter crashed, killing 13 people off the Louisiana coast. On the 8th a drilling rig in Moss Lake, La., overturned and spilled her crew of 15 into the water; 2 men died. On the 7th the Dixilyn-Field 81, a drilling rig in the North Padre Island area, was shut down and evacuated. The rig later capsized and sank in 102 ft of water.

The MARY ELLEN, carrying 280,000 barrels of oil and a crew of 37, sought refuge at Corpus Christi on the 8th, but all berths were full. She anchored off Port Aransas. When conditions worsened, the ship attempted to proceed, but her engines failed. Then her two anchors would not hold. Soon the vessel was drifting without power in 30- to 40-ft seas. The master was advised to flood all tanks and put the ship hard aground, which he did (fig. 21). On the 16th after off-loading some 150,000 barrels of crude, the vessel was refloated. Elsewhere along the northeast Texas coast, the ATHENIAN, ARGONAUT, and CHEMLINK 404 all ran aground in silted ship channels.

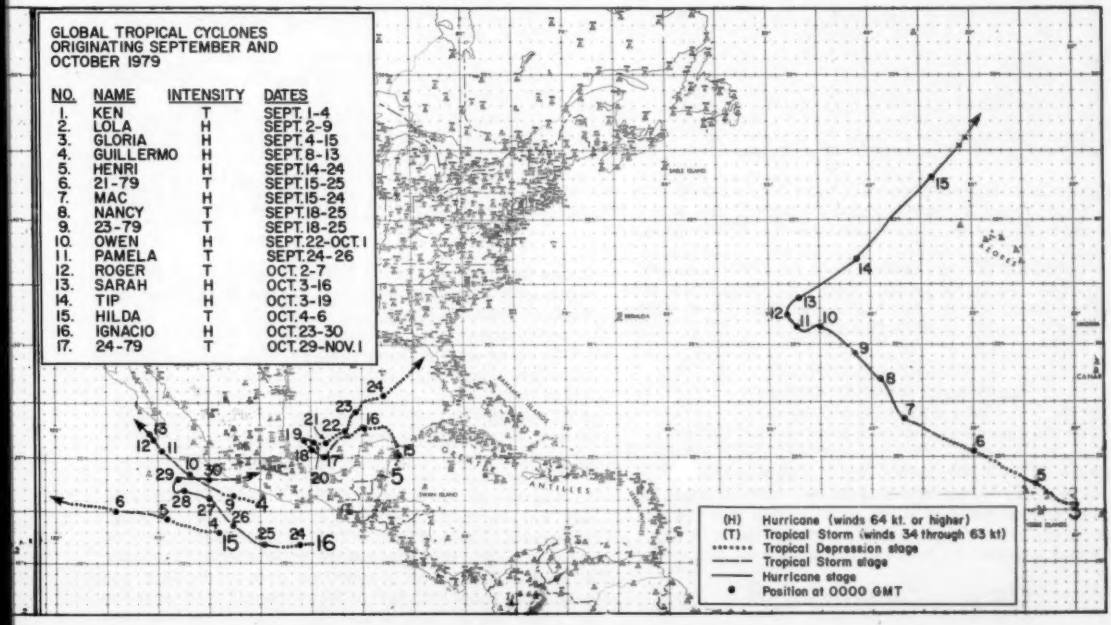
Small boat damage was extensive in the Corpus Christi area (fig. 22). In the inner harbor about 50 shrimp boats were moored to ride out Allen. It was estimated that nine of the vessels sank. The storm may also affect the shrimp season in another way. Tides up to 10 ft were responsible for cutting up to 16 new channels through Padre Island. This may affect the salinity of the Laguna Madre--a shallow shrimp-breeding ground between the island and the Texas mainland.

GLOBAL TROPICAL CYCLONES SEPTEMBER AND OCTOBER 1979

This usually busy time in the Northern Hemisphere was slightly less active than normal (fig. 23). This was due to a drop off in the eastern North Pacific and North Atlantic activity (table 6). Normally, 12 tropical cyclones develop in these two basins during the 2-mo period. This season saw only five. Near normal activity in the western North Pacific included supertyphoon Tip, who set an all-time sea-level low-pressure

Table 6.--Global tropical cyclone summary, September and October 1979

No.	Name	Peak Intensity	Est. max. wind (kn)	Basin	Dates
1	Ken	T	60	W. North Pacific	Sept. 1-4
2	Lola	H	90	W. North Pacific	Sept. 2-8
3	Gloria	H	85	N. Atlantic	Sept. 4-15
4	Guillermo	H	65	E. North Pacific	Sept. 8-13
5	Henri	H	75	N. Atlantic	Sept. 14-24
6	21-79	T	45	South Indian	Sept. 15-25
7	Mac	H	70	W. North Pacific	Sept. 15-24
8	Nancy	T	45	W. North Pacific	Sept. 18-22
9	23-79	T	55	North Indian	Sept. 21-25
10	Owen	H	110	W. North Pacific	Sept. 22-Oct. 1
11	Pamela	T	45	W. North Pacific	Sept. 25-26
12	Roger	T	45	W. North Pacific	Oct. 2-7
13	Sarah	H	110	W. North Pacific	Oct. 3-15
14	Tip	H	165	W. North Pacific	Oct. 3-19
15	Hilda	T	40	E. North Pacific	Oct. 4-6
16	Ignacio	H	125	E. North Pacific	Oct. 23-30
17	24-79	T	35	North Indian	Oct. 29-Nov. 1



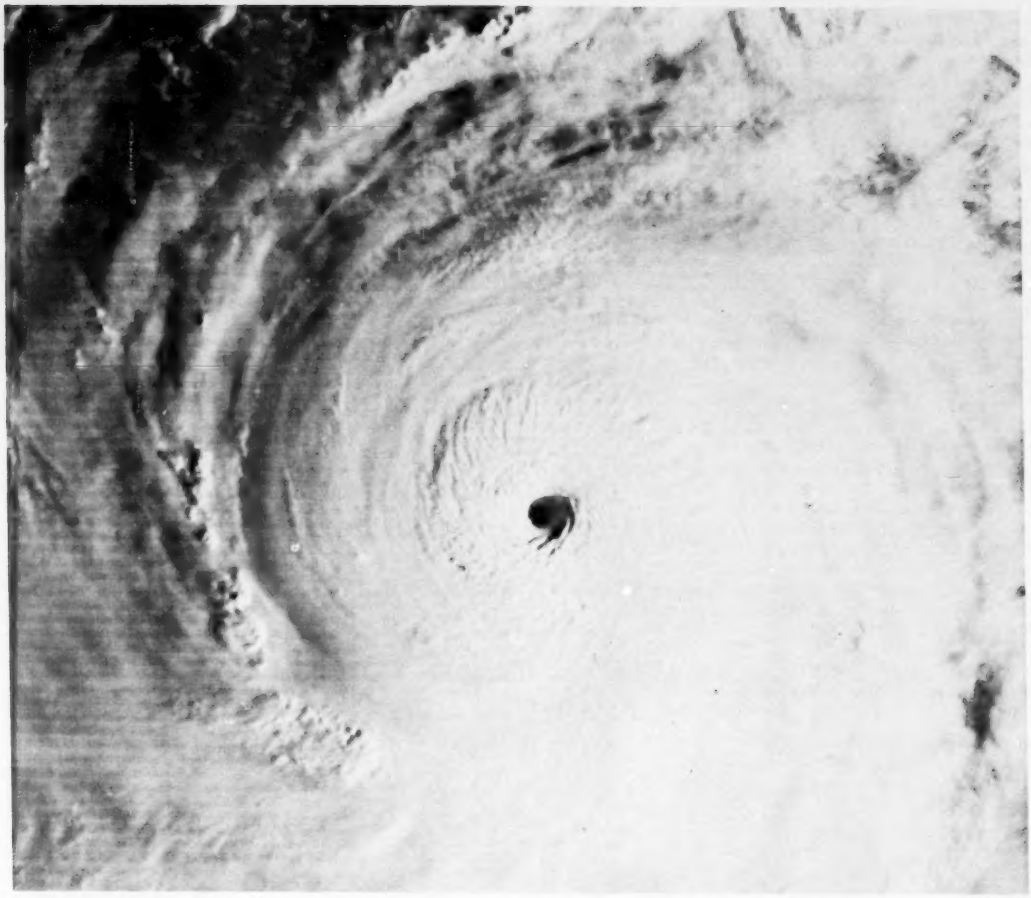


Figure 24.--Supertyphoon Tip near its maximum intensity of 160 kn on October 11, 1979, at 2127. The minimum sea-level pressure was near 870 mb, a new record, and the associated circulation pattern was 1,200 mi in diameter, also a new record. (DMSP Imagery)

reading of 870 mb on October 12 in the Philippine Sea (fig. 24). The North Indian Ocean contributed two tropical cyclones, one in each basin, while an out-of-season storm roamed the South Indian seas.

SOUTHERN HEMISPHERE AND NORTH INDIAN OCEAN JULY AND AUGUST 1980

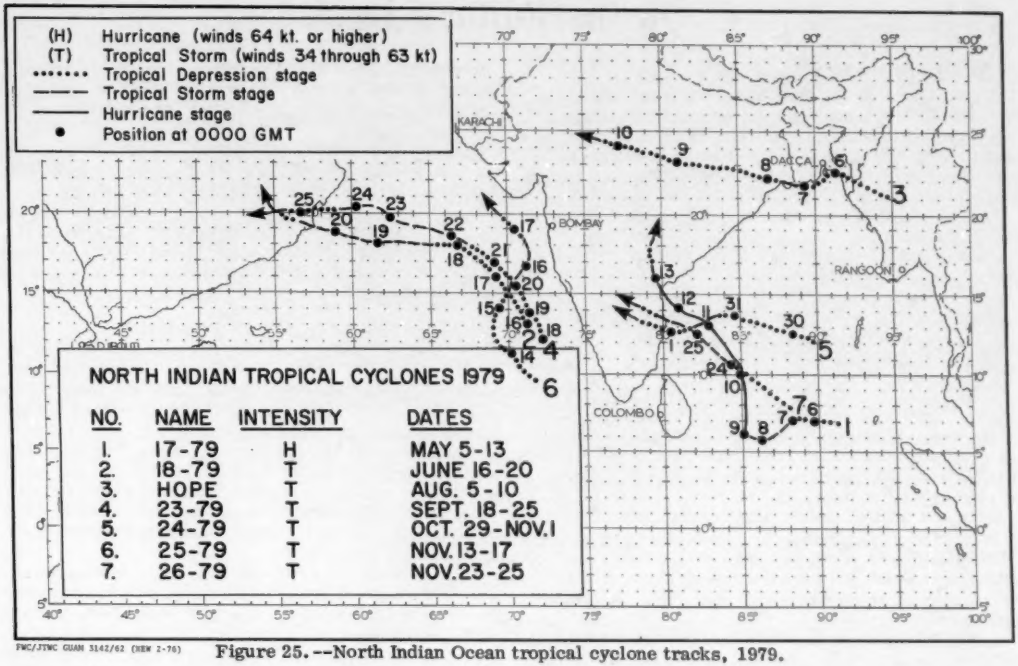
For the second consecutive 2-mo period there was no tropical cyclone activity in either the Southern Hemisphere or the North Indian Ocean. This is not surprising in the Southern Hemisphere, where activity is practically nonexistent from June through September. The North Indian Ocean usually experiences a lull in July and August--the heart of the southwest monsoon.

TROPICAL CYCLONES OF THE NORTH INDIAN OCEAN - 1979

The following summary was made possible from information provided by the India Meteorological Department. This was supplemented by data from the Joint Typhoon Warning Center.

Seven tropical cyclones roamed the Indian Seas in 1979; several were borderline storms, and one formed from the remnants of typhoon Hope from the western North Pacific (fig. 25). Only one reached hurricane strength, but it caused considerable damage and loss of life. Four storms developed in the Bay of Bengal, while three were spawned in the Arabian Sea.

The hurricane was the first storm of the year. It developed over the southeast Bay of Bengal on May 5; this was very far south for a May storm. Moving westward, then southwestward, it intensified. By the 9th winds near the center were estimated at hurricane strength. The storm reached its peak on the 11th, when maximum winds climbed to 85 kn around a 967-mb center some 160 mi east of Madras. The storm was now heading toward the northwest and crossed the coast



FWC/JTWC GUAM 5142/62 (REV 2-76)

Figure 25.--North Indian Ocean tropical cyclone tracks, 1979.

near Ongole late on the 12th. Strong winds and heavy rains were widespread across Andhra Pradesh. Rains of 8 to 16 in were common in the Prakasam district and nearby. Winds in the 60- to 85-kn range were reported in Nellore and Prakasam districts almost continuously on the 12th. Trees were uprooted and electric poles were bent. Rain swollen rivers washed away two bridges near Tanguturu (Prakasam district). About 700 lives were lost as well as 300,000 head of cattle. Total damage to crops, houses, and public utilities was estimated at 1,700 million rupees. Storm tides affected the coastal areas of Prakasam, Guntur, and Krishna districts. They ran 10 to 13 ft near Woolapalam and Pedaganjam, 10 ft near Suryalanka, and 6 to 10 ft along the coast from Nizampatnam to Hamsaladivi. Heavy rains and 40- to 55-kn winds also affected Madras City and Chingleput district. Gales and high seas caused erosion along the Madras coast.

While none of the other storms reached hurricane intensity, several did generate winds of around 50 kn. The June storm (18-79) caused the advance of the southwest monsoon into Karnataka, Goa, and south Konkan. While August is usually an inactive month, the remnants of typhoon Hope moved westward across Burma and into the northeast Bay of Bengal this August. Of the two systems that formed in September, only one (23-79) reached tropical-storm strength; its maximum winds were estimated at 55 kn. The late October and two November systems were just barely of tropical-storm intensity.

TROPICAL CYCLONE WATCH - 1980

The tropical cyclones that have developed through October of 1980 appear in table 7. This list must be considered preliminary, since we occasionally miss a storm in the Southern Hemisphere.

Table 7.--World tropical cyclone watch, 1980

Eastern North Pacific			Western North Pacific			Australia-South Pacific			South Indian		
Agatha	H	June	Carmen	T	April	Pani	T	Jan.	Hyacinth	H	Jan.
Blas	T	June	Dom	H	May	Amy	H	Jan.	5-80	T	Jan.
Celia	H	June	Ellen	H	May	Paul	T	Jan.	Jacinthe	H	Feb.
Darby	T	July	Forrest	T	May	Brian	H	Jan.	Kelia	T	Feb.
Estelle	T	July	Georgia	T	May	Dean	H	Jan.	Laura	H	March
Frank	T	July	Herbert	T	June	8-80	T	Feb.	15-80	T	March
Georgette	H	July	Ida	T	July	Enid	H	Feb.	21-80	T	Oct.
Howard	H	July	Joe	H	July	Fred	H	Feb.			
Isis	H	Aug.	4-80	T	July	Simon	H	Feb.	North Atlantic		
Javier	H	Aug.	Kim	H	July	Sina	H	March	Allen	H	July
Kay	H	Sept.	Lex	H	July	Doris	T	March	Bonnie	H	Aug.
Lester	T	Sept.	Marge	H	Aug.	Gloria	H	March	Charley	H	Aug.
Madeline	T	Oct.	Norris	H	Aug.	Tia	T	March	Danielle	T	Sept.
Newton	T	Oct.	Orchid	H	Sept.	Val	T	March	Earl	H	Sept.
			Percy	H	Sept.	Wally	T	April	Frances	H	Sept.
			Ruth	H	Sept.				Georges	H	Sept.
			Sperry	H	Sept.				Hermine	T	Sept.
			Thelma	T	Sept.				Prue	H	Oct.
			Vernon	H	Sept.						
			Wynne	H	Oct.						
			Alex	T	Oct.						
			Betty	H	Oct.						
			Cary	T	Oct.						

On the Editor's Desk

PORT METEOROLOGICAL OFFICE MOVES

Peter Connors, the Port Meteorological Officer in Nederland, Tex., has been moved to Jacksonville, Fla., effective December 1, 1980. The Nederland Office has been closed. Ships desiring meteorological service in that area should contact Julius Soileau, PMO in Alvin, Tex., at telephone 713-228-2527.

Mr. Connors address and telephone in Jacksonville, Fla., is:

Mr. Peter Connors
Port Meteorological Officer
National Weather Service, NOAA
International Airport, Box 1837
Jacksonville, FL 32229
904-757-1370

MANDATORY VTS PLANNED IN HOUSTON

The Coast Guard plans to make mandatory its Vessel Traffic System (VTS) at Houston after the beginning of the year to safeguard one of the busiest waterways for commercial vessels.

With a $1 million budget, the Coast Guard will beef up its current operations at its headquarters on the ship channel in an effort to bring greater safety control into an area which has been plagued in recent months with a rash of accidents which many feel could have been avoided.

Some towboat operators feel the system should be left on the voluntary system it has operated under since its inception 5 yr ago, but the Coast Guard sees little possibility of any problems once the tracking system becomes mandatory. Currently 95 percent of the shipping companies using the ship channel are working with the project, and the rest probably will follow.

The vessel tracking system, which will be the second in the Gulf (the other is on the Mississippi River south of New Orleans), operates via a ship-ship communications system, a radar and computer network, and a bank of television equipment at the Coast Guard station on the ship channel.

Using a series of television screens which scan and track the movement of ships on the channel, the Coast Guard and its 45-member staff can monitor the movement of traffic in the channel from the head of the numerous docks on the waterway to the final clearance point on Galveston Bay. If necessary, penalties, as yet unspecified, would be handed out to vessel operators not complying.

Pilots opposing the mandatory VTS claim the money going into the tracking system could be spent better widening the ship channel and deepening the waterway. The port maintains a 40-ft channel from the Gulf to the inner harbor which protestors claim is inadequate to handle the larger and more sophisticated ships using the waterway.

The Coast Guard denies the mandatory system was prompted by the numerous accidents occurring in recent months at approaches to the channel south of Galveston. Mandatory VTS has been under consideration for 3 yr.

Over the last several months a number of collisions, most of them involving tankers, have caused millions of dollars in property damage and the deaths of several crewmen. The Coast Guard has already completed a survey of the region to determine the cause, and plans several changes to avert accidents in the future in this area.

While most realize the importance of VTS as a safety factor, voluntary use of VTS also has cut transit time of shipping.

At the beginning of the year VTS will operate around the clock, keeping navigators on ships' bridges in constant communication, while providing the Coast Guard with a record of every vessel moving in either direction in the channel, via the closed television system.

NEW DEVICE MAY REDUCE FOG CALLS

A new fog detection device now undergoing tests by Yaquina Bay Coast Guard Station in Oregon may help reduce small craft losses in the predawn, foggy darkness when most noncommercial fishing boats head out to the offshore grounds.

The device is the brainchild of three Oregon State University scientists at the university's campus in Corvallis, and at the Marine Science Center at Yaquina Bay. Project Leader is David Zopf, assisted by meteorologist William H. Quinn, and data processing expert H. Clayton Creech.

The project, 10 yr in development, had been awaiting installation of sensing instruments to measure seawater temperature and air temperature, both with a remote indicator.

The instruments are located in the vicinity of the entrance channel at Yaquina Bay and at six other Pacific Coast harbors. The National Weather Service paid for the air temperature devices and Sea Grant installed the sea-water temperature instruments. The remote readouts are located at nearby Coast Guard Stations.

The radiometer fog detector is an instrument which detects and measures radiant energy, in this case measuring radiated sea-water temperature. Located high in a Coast Guard lookout tower, it is sighted on the harbor entrance channel where the sea and air temperature measuring devices are also positioned. When the temperature measured by the radiometer matches the sea water temperature, it indicates clear weather. However, when there is a marked temperature difference between the sea-water temperature and that displayed by the radiometer, fog is present.

If the device proves to be as valuable as present tests seem to indicate, it could save the Coast Guard from making about 75 distress runs annually to assist vessels lost in the fog off Yaquina Bay.

LYKES CREW HONORED FOR RESCUE

The crew of a Lykes Bros. Steamship Company vessel was honored recently in New Orleans for saving the life of a man found clinging to debris in the South China Sea.

Captain L. R. Petersen, master of the LIPSCOMB LYKES accepted the award on behalf of his crew during ceremonies at the International Trade Mart.

The award was for first place in the 1980 Ship Safety Achievement sponsored by the American Institute of Merchant Shipping.

The rescue occurred on April 20, 1979, when the

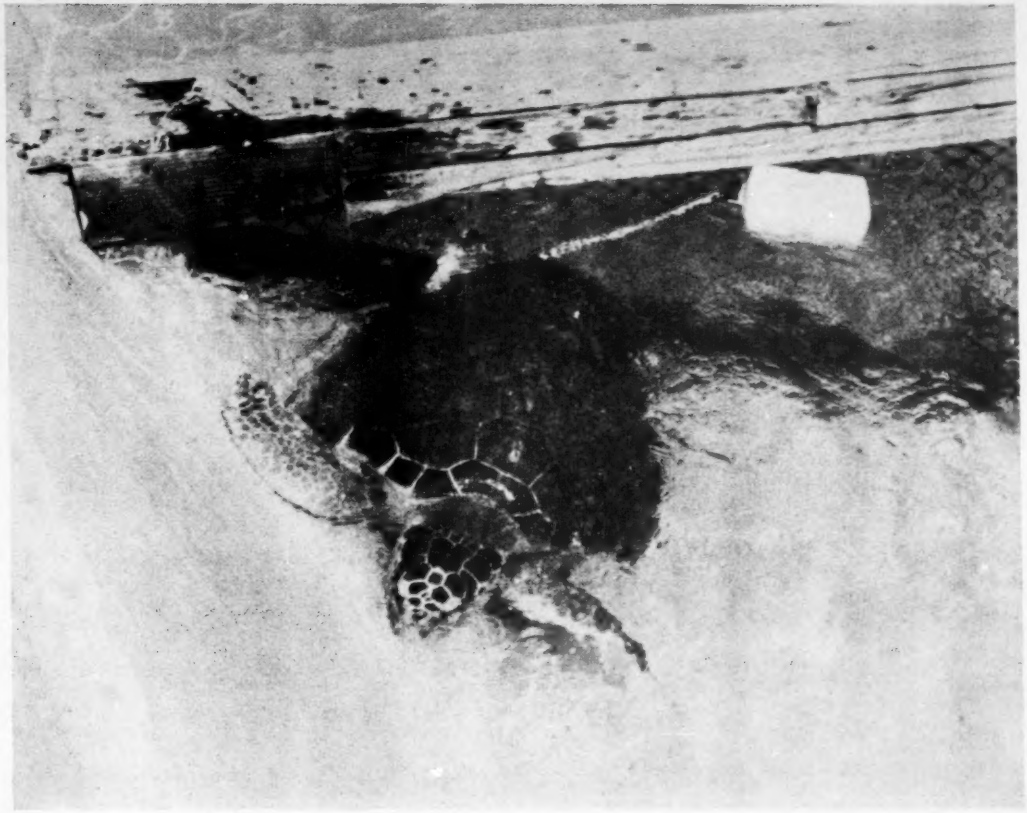


Figure 26.--Dianne is shown prior to release with the transmitter attached to her shell.

LIPSCOMB LYKES was bound from Hong Kong to Busan, Korea. The watch officer sighted a man clinging to a Chinese junk. The LIPSCOMB LYKES was maneuvered close to the man, despite choppy seas, and a line was lowered, allowing the man to be lifted to safety.

Also at the ceremonies, the crew of the GENEVIEVE LYKES received a citation of merit for the rescue of five Indochinese fishermen found adrift in the South China Sea. The fishermen had spent more than 30 days adrift.

SEA TURTLE TRACKED BY SATELLITE

A satellite has been used successfully to track the 800-mi odyssey of a turtle dubbed Dianne (fig. 26). NOAA reported that a 212-lb loggerhead was tracked via transmitter from its release point south of Gulfport, Miss., southward around the mouth of the Mississippi River; westward, offshore from Louisiana into Texas; and southward to an area in the Gulf of Mexico offshore from Brownsville, Tex.

The signals from the tracking device attached to Dianne's shell were beamed at 4-day intervals to NASA's Goddard Space Flight Center in Greenbelt, Md., where they were processed by computer. The tracking of Dianne lasted from October 16, 1979, to June 15, 1980, when the turtle apparently shed the transmitter.

After a brief break in transmission, NOAA said that a mystery developed when the signal from the transmitter started anew and inexplicably began moving inland, finally stopping in landlocked Kansas, far from Dianne's ocean and rivermouth habitat.

The mystery was caused by a fisherman who found the 7-lb transmitter on a beach 30 mi west of Port Arthur, Tex. He took it home to Kansas where he was using the $5,000 device as a doorstop.

NOAA's National Marine Fisheries Service laboratory in Galveston, Tex., called the unusual use of the NIMBUS satellite an unqualified success. Satellite tracking has great potential because of the inaccessible nature of the animal (turtles). No other technology is capable of following a wide-ranging mammal over so large an area.

Learning the routes the turtle took will help NMFS to identify feeding, nesting, and mating areas. This information can be used to develop strategies for managing the stock of sea turtles.

Satellite tracking of turtles was inspired by a previous experiment with polar bears. The bears were tracked from 60 to 90 days.

The loggerhead, a threatened species, was chosen for the project because of its size and availability. However, the success of the experiment prompted the bugging of a smaller Kemp Ridley turtle with a similar satellite transmitter in early June. Signals from the second turtle indicate that it has not moved far from where it was originally tagged off a Mexican beach.

NOAA SATELLITE UNIT RENAMED

NOAA's National Environmental Satellite Service has been upgraded and renamed to reflect new and broader responsibilities. It will now be known as the National Earth Satellite Service (NESS).

Earlier this year NOAA was assigned the responsibility for developing and managing a civil, operational, land remote sensing satellite system based upon the technology of the NASA experimental Landsat program.

NOAA and its predecessor agency, the Environmental Science Services Administration, have managed the nation's operational weather satellites since 1965. Imagery and data from these spacecraft have been used broadly for weather forecasting and such environmental monitoring as marine navigation, commercial fishing, and water resource management.

The Landsat system, with its greater resolution, is expected to be of even greater value for such monitoring and provide data for farming, urban planning, mineral exploration, and other activities.

CHESAPEAKE BAY FORECASTS EXPANDED

Recreational boaters who sail the Chesapeake can now venture into remote regions and know the wind and wave conditions that they will encounter because the National Weather Service has expanded marine forecasts. Nineteen volunteers are now reporting conditions from formerly data-sparse areas along the Bay.

The volunteers, all Chesapeake Bay residents, report directly via touch-tone telephone to the NWS computer in Suitland, Md. They phone in the data three times a day, 7 days a week.

The volunteers estimate wave heights in 1/2 to 1-ft increments. They also note the visual roughness of the Bay.

Wind velocity is measured with a hand-held wind gage, or anemometer.

NOAA started the experimental program last year with 10 observers. Participants were recruited through a door-to-door campaign. They were chosen on the basis of their residency along the Bay, to ensure familiarity with its conditions, and their location near a desirable point for wind and wave observations.

YOUR TV MAY BE HAZARDOUS TO YOUR LORAN-C RECEIVER'S HEALTH

Television receivers use a horizontal picture scanning frequency of about 15,750 Hz (color sets have a slightly lower frequency). The oscillators used to produce these scanning frequencies are simple devices with little or no shielding and no band limiting to reduce harmonics. Many harmonics (multiples) of the basic frequency are produced and are sometimes radiated by the receiver's antenna system. Two particularly troublesome harmonics for Loran-C receivers are at about 94.5 kHz (6th harmonic) and 101.25 kHz (7th harmonic). Since the Loran-C signals occupy the band between 90 and 110 kHz, a correctly designed Loran-C receiver will accept these TV oscillator harmonics. If the level of the unwanted signals is high enough, the signals may produce erratic Loran-C receiver performance. You, or your marine electronics dealer, can easily determine whether you have this problem by observing the performance of the Loran-C receiver with the TV set turned on and turned off.

TERMINATION OF LORAN-A

The Loran-A navigation system will be terminated in the Caribbean and along the U.S. East and Gulf Coasts at 2400 December 31, 1980. This termination was first announced in 1974, when Loran-C was adopted for the Coastal Confluence Zone (CCZ) of the United States. Loran-C has been in operation in U.S. East and Gulf Coast waters since 1978. An approximate 2-yr overlap of Loran-A and Loran-C service was originally scheduled to allow time for the public to convert to new receivers and for fishermen to convert bottom obstruction data from Loran-A coordinates to Loran-C coordinates. Termination of Loran-A, planned during the summer 1980, has been extended until December 31 to minimize impact on users.

SUNSPOT ACTIVITY AT HIGHEST LEVEL IN 400 YR

A surge in the Sun's energy has raised sunspot activity to a level unsurpassed since it was first monitored nearly 400 yr ago. According to NOAA, the sunspots, which normally follow an 11-yr cycle of maximum and minimum activity, are now at a peak period unmatched since they were first recorded in 1609.

Sunspots are areas of darker and cooler gas on the Sun's surface caused by extra strong magnetic fields. They have no direct effect on the Earth, but the energy they emit interferes with short-wave radio transmissions and poses problems for ship and airplane communications. They can also cause minor problems in TV reception.

MARINE TRANSPORT WINS SAFETY AWARD FOR TANKER RESCUE

Marine Transport Lines Inc. of New York has been presented a Ship Safety Achievement Award for the bulk tanker SAN DIEGO's rescue of three men from a sinking salvage boat last year. The rescue involved "extraordinary seamanship, manning and launching a lifeboat in winds gusting to 45 kn and 6-ft seas," in Prince William Sound, according to the American Institute of Merchant Shipping. James H. Rand, company president, and Captain William MacFadden, SAN DIEGO master, attended the award ceremony.

Marine Transport Lines also was awarded a Citation of Merit for two separate incidents within a month last year in which 52 Vietnamese refugees were rescued by the SEALIFT ARABIAN SEA, a Military Sealift Command ship operated by Marine Transport under command of Captain R.P. Ruse.

VESSELS REFLOATED IN THE GULF

Workers have refloated the last of four vessels that ran aground after hurricane Allen reshaped the Texas

coastline, and the Corps of Engineers has been working to clear tons of silt from area channels.

Chem-Link Barge 404 was refloated in the Intracoastal Waterway 25 mi north of Port Mansfield on August 17, after some of her lube oil cargo was removed to another barge. Two tankers and a freighter grounded elsewhere were refloated during the 14th to the 16th.

The entrance channel at Corpus Christi was dredged, and surveys were run on all waterways.

Two and one-half miles of the entrance channel outside Aransas Pass had accumulated as much as 10 ft of silt. The channel, normally 49 ft deep at that point, was 37 ft deep where the tanker ATHENIAN grounded.

The storm built shoals in other channels, including Matagorda Bay entrance channel, and cut several new passes through the 113-mi-long barrier islands, Padre and Mustang islands.

The tanker MARY ELLEN ran aground off north Padre Island on August 9 as Allen came ashore in Texas. The MARY ELLEN was refloated on the 16th. Refloating of the tanker was delayed by a shortage of barges for removing cargo.

After the storm, the tanker ATHENIAN grounded outside Aransas Pass, the freighter ARGONAUT ran aground at Matagorda Bay, and the barge stuck in the Intracoastal Waterway which runs behind Padre Island south of Corpus Christi. The ATHENIAN was refloated on the 14th and the ARGONAUT on the 15th.

SAIL SHIP CLAIMS FUEL SAVING

The first energy-saving sail-equipped commercial ship was launched recently in Japan amid claims that its sails and other equipment could cut fuel costs by as much as 50 percent over conventional craft.

Two large plastic sails assist the diesel engine of the 1,600-ton tanker SHIN-AITOKU MARU, constructed by a Japanese coastal shipping company.

The ship cost $2.3 million to build, about 20 percent more than normal for a ship of its size, but the owner is predicting it will save around $450,000 a year in fuel.

Sails and engine are linked by a microcomputer, which automatically switches power source in response to conditions. When not in use the sails, which measure 39 ft by 26 ft, are folded automatically against the steel masts.

The modern technology employed in the working of the sails means the SHIN-AITOKU MARU needs a crew of only eight on its coastal service linking China, Malaysia, Indonesia, and Japan.

Besides using sails, the vessel is said to incorporate a number of other energy-saving designs to both hull and engine. It is much narrower than conventional ships, and the engines are designed to fully use waste gas which would otherwise be expelled.

A Japanese company has tested 20 sail configurations, with three being tried on a small test craft. It estimates savings of as much as 20 percent for a 20,000-ton bulkcarrier, with the sails being used in conjunction with the engine.

Further research is being done in the United States, Belgium, Denmark, Germany, Indonesia, and Russia mostly on the use of sail for bulkcarriers and small coastal cargo vessels.

ICEBERG THREAT TO OIL DRILLING

The waterway that icebergs take as they drift between the Greenland and Canadian coasts to distinction in the relatively warm northwest Atlantic is sometimes referred to as iceberg alley (fig. 27).

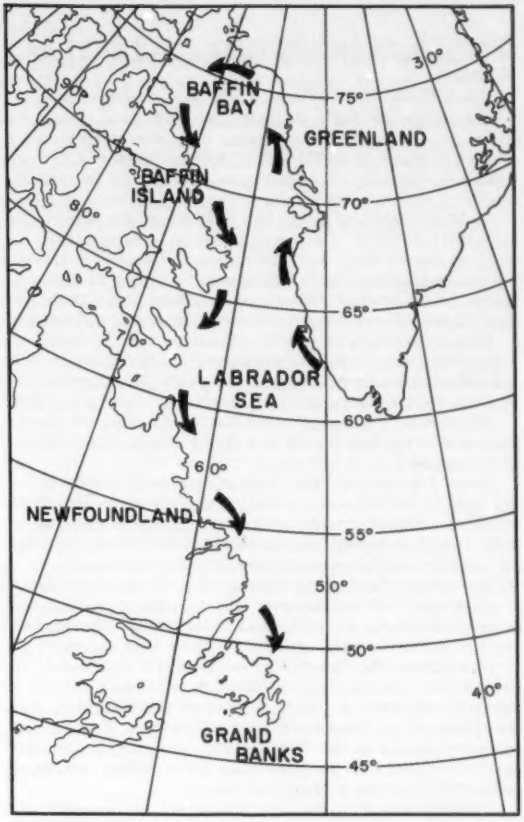


Figure 27.--This map shows the mean track of icebergs when they break off the coast of Greenland.

The alley is one of the world's most treacherous bodies of water and covers some giant geological structures that have great oil potential. Several promising oil and gas finds have already been made in the area, and the region's potential barely has been tapped.

Eight exploratory wells are currently being drilled off eastern Canada, five of them in iceberg alley. The first well on the Canadian side was drilled in 1971 and had to be hastily abandoned because of a threatening berg.

The basic technique now is to try to deflect a menacing berg from a collision course with the drill ship. If this fails, the drill ship suspends operations and moves out of the way. Deflections are done by tugboats. They circle a berg with a towline, usually 4,000 ft of 4-1/2 in diameter braided polyethylene with a breaking strain of 100 tons.

Icebergs are probably the largest objects man has attempted to move. Some as heavy as 2 million tons have been maneuvered. As their change of course under tow is often imperceptible, the operation is called a deflection rather than a tow.

After a berg is lassoed the start up must be smooth

or the towline can pop over the top and spin into a 4,000-ft knot.

The PIONEER SERVICE, a 206-ft tug supply boat, is defending the BEN OCEAN LANCER drill ship, which is drilling a well at Hekja, a location off the southeast coast of Baffin Island facing Greenland's west coast iceberg breeding grounds. It is the most northern east coast well now being drilled.

Iceberg traffic at Hekja has been light this year compared to 1979. During an average iceberg alley drilling season from July through mid-October a drilling vessel off Labrador can expect 29 alerts of icebergs within 5 mi, 13 towing operations, and a 50-percent chance of collision if defensive action is not taken.

So far, the tugs have not been called upon to deal with a berg they could not maneuver, although some operations have been tricky; a berg is highly unstable, shifting with the current and periodically rolling over.

The deflect-or-dodge procedures have allowed companies to drill, but the oil industry is not sure how it will produce the oil and gas.

Mobil Oil Canada Ltd., with its Hibernia field 193 mi east of Newfoundland and about 200 mi north of where the Titanic passenger liner sank after colliding with a berg on her maiden voyage in April 1912, is expected to point the way. Hibernia is on the Grand Banks, a rich fishing zone that geologists say was once above water. While Hibernia is not on the main iceberg track, bergs nevertheless stray into the area, and any production system has to take them into account.

Floating production platforms are favored since they can be disconnected from production wells and maneuvered out of the way. Big bergs scrape the seabed, so the Hibernia wellhead equipment will have to be buried. Iceberg furrows on the Grand Banks are comparatively shallow--6 to 15 ft--so protecting the wellhead equipment should not be a great problem.

Icebergs are almost pure fresh-water ice and very strong. Efforts to speed up the melting process and attempts to blast them apart with explosives have achieved little success. Since the Titanic disaster, the U.S. Coast Guard International Ice Patrol has tracked icebergs that drift toward North Atlantic shipping lanes, but oil companies complain that data on berg movements farther north is sketchy, partly because the waters between Greenland and Canada have little shipping traffic.

NASA TESTS NEW STORM OBSERVATION INSTRUMENT

The GOES-D meteorological satellite, launched on September 9, 1980, from NASA's Kennedy Space Center, Fla., for NOAA carried a new type of instrument known as the VAS, or Visible Infrared Spin Scan Radiometer (VISSR) Atmospheric Sounder.

Scientists at NASA and the University of Wisconsin will conduct a long-term experiment to evaluate the usefulness of this instrument for prediction of hurricanes, severe local storms, and other short-term weather phenomena.

Previous GOES spacecraft provided day and night, two-dimensional cloud-cover photos. The new atmospheric sounder, in addition to this same imaging capability, will be able to measure atmospheric temperatures and moisture at various altitude layers. As with previous GOES satellites, the new instrument will provide both day and night cloud-cover photos with a resolution of approximately 0.9 km (.55 mi) in daylight and 6.9 km (4.28 mi) at night.

GOES satellites are geosynchronous, hovering over one spot on the Earth. This experiment will inaugurate a new use for these satellites that will require observation scenarios, data processing systems, and analysis programs differing markedly from those for polar-orbiting (north-south) weather satellites, such as the TIROS-N series. Since GOES is stationary with respect to the Earth, it can observe storms as they develop and hence should be useful in a forecast and warning system.

Over the past few years, scientists from NASA, NOAA, and the University of Wisconsin have been developing ground-based data processing facilities at Goddard and the University. These facilities will be used during the next few years in this experiment to assess the usefulness of VAS data for weathercasting and for increasing understanding of short-lived weather features such as tropical storms, midlatitude cyclones, and thunderstorms.

MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

May and June 1980

SMOOTH LOG, MAY 1980--This was another anomalous month across the North Atlantic. There appeared to be fewer storms and they were widely scattered, especially over North America. Ordinarily, there are three primary tracks over water. One is from the Great Lakes to the Gulf of St. Lawrence, where it splits to the Davis Strait and Denmark Strait. Another is from Delaware Bay northeastward to the Norwegian Sea. A branch splits off this one to the Orkney Islands. A secondary track enters Europe

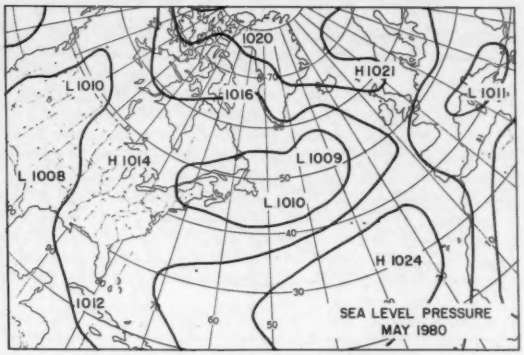


Figure 28.--Mean sea-level pressure.

over the Bay of Biscay. This month the only concentration of storm tracks was from the U.S. East Coast northeastward to the Flemish Cap, then northward to the Denmark Strait. Only two storms entered Europe from the west, and they were in the first week.

The Icelandic Low on the mean sea-level pressure chart was divided into two centers this month, both far from Iceland. One 1009-mb center was at 50°N, 35°W, and a 1010-mb center was over Cape Race. This compares with a climatic 1009-mb LOW near 58°N, 35°W, and a 1014-mb center near Oslo. The Azores High at 1024 mb at 30°N, 30°W, was about 400 mi east of its climatic normal of 1022 mb. A ridge of high pressure extended from the Azores High northeastward toward Cape Finisterre, then northward over the Irish Sea, and on to a large 1032-mb High over the Arctic Ocean. A small 1021-mb High was near the Faeroe Islands (fig. 28).

There were two major anomaly centers, both 7 mb. The minus 7 mb was near 45°N, 35°W, and the plus 7 mb was near the Faeroe Islands. There was also a minus 4-mb center over the Mediterranean Sea, but ship information did not indicate any severe storms.

The upper air pattern at 700 mb reflected the paths traveled by the surface cyclones. The primary center of circulation was higher than normal but normally located over Devon Island. A second center was off Marys Harbor, Labrador. The long-wave trough was shifted from 65°W longitude to 55°W longitude over Newfoundland but was near normal at 70°W and 30°N. An anomalous HIGH was over the North Sea, which greatly accented the usual slight ridging over Iceland and Greenland.

There were no tropical cyclones.

Extratropical Cyclones--High pressure over the northern ocean continued from April into May. By May 7 the HIGH had built to 1046 mb over northern Greenland. and its influence extended southward to latitude 50°N.

This first storm of the month was found east of Newfoundland on the 0000 analysis of the 2d. At 1200 the C.P. TRADER found 52-kn winds with 20-ft waves, and the MAERSK COMMANDER had 44-kn winds with 15-ft waves, both in the southwest quadrant in the vicinity of 47°N, 42°W. At this time the LOW was 991 mb near 50°N, 41°W. The storm was moving slowly eastward against a blocking 1035-mb HIGH over the Norwegian Sea. The ATLANTIC SAGA had 44-kn northwesterly winds blowing on her starboard bow at 1200 on the 3d while about 400 mi west of the LOW. The ULTRASEA was southeast of the center with 26-ft seas.

On the 4th the storm dropped 3° latitude to the south as it traveled south of the HIGH. On the 5th the MARITIME DOMINION (49°N, 10°W) was east of the LOW with 48-kn winds. The storm was weakening as it moved between high pressure to both the north and south, but the AMERICAN LEGEND (47°N, 12°W) located 40-kn winds and 16-ft waves. On the 8th the storm crossed into France and disappeared.

As a LOW that had originated off Cape Hatteras passed over the Grand Banks, it dissipated; and another formed near the Flemish Cap on the 7th. The CETRA VELA (49°N, 38°W) was northeast of the storm's center with 56-kn winds. At 1200 on the 8th the storm was 990 mb near 48°N, 35°W. Two ships reported winds over 50 kn. They were the CETRA VELA (48°N, 45°W) with 58 kn and the MARITIME DOMINION (44°N, 37°W) with 52 kn. The RUBENS (51°N, 35°W) was only 2 kn below 50 kn. The highest waves were 23 ft.

On the 9th the storm turned northward as the Arctic High weakened and retreated. At 1200 the 984-mb storm was near 51°N, 27°W. The RUBENS now had 55-kn winds with 20-ft seas and 39-ft swells. A ship near 60°N, 28°W, had 33-ft swells. Much farther south the SEA-LAND RESOURCE entertained 50-kn winds from the south. On the 10th the strong easterly circulation reached the Icelandic fishing fleet and they reported winds over 50 kn. A ship off Ireland had 25-ft waves. On the first observation on the 11th OWS Charlie had 45-kn winds with 20-ft seas. The YUKON T-AO 152 (57°N, 39°W) found 30-ft swells. The storm was weakening and by the 12th had broken into three centers and was no longer any threat.

Over the next 10 days this ocean was relatively quiet. Many circulation centers, both cyclonic and anticyclonic, traversed the water, but none caused much excitement.

On the 19th a frontal wave formed over the Texas Gulf Coast. At 0600 on the 21st it was over Norfolk. At 1200 the DELAWARE GETTY was north of the Bahamas with gales from the south. On the 22d the TFL DEMOCRACY found 28-ft seas about 120 mi to the south of the center. As the storm traveled along the Gulf Stream, it broadened its circulation and on the 23d was near Cape Race at 980 mb. Ships in the vicinity of 46°N, 50°W, were now reporting gales. A U.S. ship found 50-kn winds near 47°N, 49°W. Another ship nearby had 21-ft waves. The storm stalled at this point and remained stationary through the 25th.

Back to the 23d. At 1800 the PEGASIA was near 48°N, 47°W, with 60-kn southeasterly winds. On the 24th the winds over the Grand Banks were generally gales, but the ATLANTIC CONVEYOR (47°N, 40°W) had 44-kn winds with 23-ft seas and swells. The storm was gradually weakening, and on the 26th a frontal wave traveled south of it contributing to the process. The ARGONAUT found 50-kn winds with this wave on the 27th. The LOW finally disappeared from the analysis on the 29th.

A series of frontal waves traveled northeastward south of the storm above as it moved slowly northward. One

of these persisted and by the 29th was forming a good circulation. Late that day the MEONIA with 39-kn winds was not far from OWS Romeo, which was reporting 21-ft waves.

The storm had been moving northeastward, but on the 30th the center suddenly jumped westward. It absorbed the LOW described above with a realinement of the upper air pattern. The AFANASIY NIKITIN (56°N, 35°W) was caught in this with 41-kn winds and 26-ft seas. At 1200 the MIROSLAWIEC (56°N, 34°W) was contending with 47-kn winds. No seas were reported. A few gales continued to be reported on the 31st, but the storm was deteriorating rapidly.

Casualties--The 6,739-ton Brazilian LLOYD BAGE struck ice floes off Helsinki and leaked fuel oil. The Norwegian tanker LAKE ANJA arrived St. Johns with ice damage. The American wood auxiliary vessel ARTEMIS sank in rough weather in the Gulf of Mexico on the 9th. The tug OCEAN SUN rescued all the crew. The 19,734-ton SUMMIT VENTURE collided with the Sunshine Skyway Bridge in Tampa Bay, Fla., during a thunderstorm. A bus and five vehicles fell off the bridge before it could be closed, with 35 lives lost.

The Liberian ARHON requested heavy-weather survey at Marseilles on the 12th. The 3,313-ton RIO SULACO reported heavy-weather damage on the 12th on arrival at Havre. The roll-on/roll-off vessel IVA suffered heavy-weather damage prior to the 21st. The ore carrier AL TAWWAB suffered heavy-weather damage on a voyage from Port Elizabeth to Taranto.

SMOOTH LOG, JUNE 1980--The storms this month were weak, even for a summer month. The paths over North America were more consolidated and matched climatology better than over water. There was a primary path from the central United States to over the Great Lakes and Labrador. Another path was from western Canada to the lower Hudson Bay and then into Davis Strait. The normal track along the East Coast was about 500 mi off the coast and dispersed. Off Newfoundland some of these storms turned northward, while others turned eastward. Some of the storms from Labrador continued toward Iceland. A few storms traversed northern Europe. There were none over the Mediterranean.

The most significant feature on the mean sea-level pressure chart was the Azores High at 1030 mb near 37°N, 34°W. This was 6 mb higher than normal and about 300 mi north of its normal position. There were three major ridges associated with the High: one extended into the southeastern United States; another into the Mediterranean; and an anomalous one toward Iceland, splitting the Polar Low. The Aleutian Low did not exist. Instead, there were three weak centers. One was 1008 mb near the Shetland Islands, another 1009 mb west of Goose Bay, and the third 1012 mb near Disko Island, Greenland (fig. 29).

The largest anomaly was plus 7 mb and centered near 40°N, 32°W. It covered the east-central ocean and bulged northward to southeastern Greenland. There was a minus 6-mb anomaly center over the North Sea which affected northern Europe. The Low near Goose Bay produced only a minus 2-mb center.

The upper air flow pattern was a closer match with

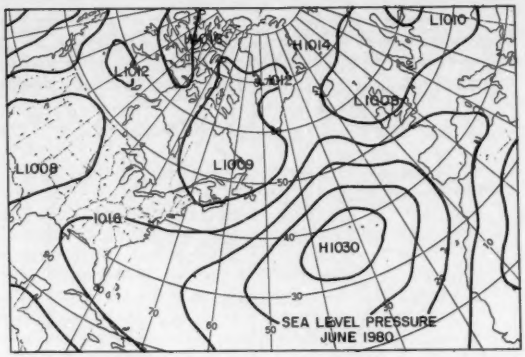


Figure 29.--Mean sea-level pressure.

climatology. The primary departure was a Low near the Faeroe Islands reflecting the surface Low near the Shetland Islands. This produced a trough over western Europe and accented the ridge along longitude 30°W. There was the normal Low over Baffin Island with a trough southward off the U.S. East Coast.

There were no tropical cyclones this month.

Extratropical Cyclones--The first week of the month the Azores High was relatively weak and split into two widely separated centers. By the 6th it consolidated into one large stubborn center over the islands it was named after and persisted for all practical purposes for the remainder of the month. Low-pressure centers were diverted northward as they came against its northwestern edge. There appeared to be more low centers than normal, but most were weak and of little concern to ships.

The first significant LOW came from north of the Great Lakes and was over Newfoundland on the 2d. At 1200 the C.S. ALERT was in the southeast quadrant with 48-kn winds. On the 3d the MANIFEST LIPCOWY at 38°N, 61°W, was in the same vicinity with 39-kn winds. Later in the day the winds increased to 47 kn as the ship sailed eastward. By the 4th the storm had turned northeastward and at 0000 was near 50°N, 50°W, at 1002 mb. The MANIFEST LIPCOWY near 40°N, 55°W, had 48-kn winds. The LOW disappeared late that day.

Monster of the Month--This LOW developed over New England and by 0000 on the 4th it was over Cape Cod. The CAPE BRETON HIGHLANDER found 35-kn winds off Norfolk, Va. The LOW raced eastward and at 1200

the C.S. ALERT (39°N, 65°W) again found 48-kn winds. On the 5th the storm was turning northward and there were no gales reported.

On the 6th a frontal wave was found south of the LOW. The DALAMAN was southeast of this circulation with 47-kn southerly winds and 26-ft seas. This LOW developed as the original one dissipated. At 1800 the CAPE BRETON HIGHLANDER now near 46°N, 60°W, reported 62-kn northerly winds. The TROLL PARK (44°N, 54°W) had 43-kn winds from the northeast. At 1800 on the 7th the ZYBARDOW (36°N, 46°W) had 41-kn southerly winds just prior to penetrating the front. The LOW was moving northward and weakening. By the 9th it was gone.

This LOW was discovered south of Lake Superior early on the 7th. There were heavy thunderstorms associated with it as the storm traveled across the Lakes. Once in a while a saltie on the Great Lakes will radio a weather observation. At 1200 on the 8th the PIER radioed winds of 37 kn from the northwest on Lake Erie. At 0600 the MESABI MINER also had 37-kn winds from the north on Lake Michigan. The seas were 6.5 ft.

The southwesterly flow south of the warm front reached the Atlantic on the 8th. The MONTCALM was east of Delaware Bay and south of Cape Sable at 1800 with 36-kn gales. On the 9th at 0000 the ATLANTIC BEAR was near the same location with 35-kn gales. At 1200 several ships along an average latitude of 47°N had gales. At 1800 the SEATRAIN ANTWERP (40°N, 54°W) topped them all by finding 33-ft swell waves.

The LOW was now 984 mb over northern Quebec. It was a large LOW, and its circulation still was affecting the Great Lakes and the western Atlantic. The T.W. ROBINSON on northern Lake Michigan had 42-kn winds from the north. Two American ships near the cold front (47°N, 48°W) had gales. The LOW continued northward then turned eastward to die over Davis Strait.

On the 13th there was an ill-defined low-pressure system over Davis Strait that was a combination of the last storm described and several other LOWs. On the 1200 analysis another low center was found south of Kap Farvel. By 1200 on the 14th the 990-mb center was at 55°N, 31°W. The cold front passed a ship near 47°N, 25°W. The winds had shifted to westerly, but the 26-ft swell waves were still from the south-southeast. Ocean Weather Station Charlie was receiving 41-kn northwesterly winds and 18-ft seas in the southwest quadrant. At 1800 the C.P. DISCOVERER was within a few miles of Charlie with 40 kn also. A ship south of the center had 23-ft seas on the 15th.

Another LOW had been following closely behind this one, and yet another was moving northward over the United Kingdom. On the 1200/15 analysis, there were four weak centers supporting a large cyclonic circulation which reached as far south as 35°N. There were several reports of gales and even more of 16-ft waves. By the 16th the LOW over the United Kingdom had become the primary one and was headed toward Iceland. The CUMBRIA (46°N, 18°W) found 41-kn winds. This LOW stalled over Iceland and dissipated on the 17th.

This maritime storm originated over the Maritime Provinces on the 16th. The SEDCO 709 off Cape Race had gales as did the ZAPATA UGLAND only a few miles away. The USNS COMET had 39 kn south of Cape Sable on the 17th. The WVFN was doing a good job of reporting, but its name could not be identified. The 988-mb storm was near 57°N, 32°W, at 0000 on the 18th. A trough line had just passed OWS Charlie with 40-kn winds and 21-ft seas. Later in the day the storm passed north of OWS Lima with 40-kn winds. A U.S.S.R. ship near Lands End reported 50-kn winds from the southwest. Many others were reporting gales. The highest seas were 26 ft reported by the CALLAGHAN. At 1800 on the 18th and 0000 on the 19th the PIONEER CONTENDER in the vicinity of 55°N, 22°W, was sailing into 50-kn westerly winds and seas as high as 36 ft.

On the 19th Lima reported winds up to 45 kn and seas to 23 ft. Several ships had gales over 40 kn and seas as high as 23 ft. A Canadian ship (VCKW) at 55°N, 15°W, had 44-kn winds and swell waves following 33 ft. The storm was over Shetland Islands on the 20th bringing high gales and rough seas to the crowded North Sea.

The storm made a cyclonic loop east of the Faeroe Islands on the 20th and 21st and then stalled for 24 hr before continuing to loop toward Denmark. It was constantly weakening during this period.

This severe weather over the western Mediterranean was associated with a front out of a LOW that was over Norway. The cold front was moving southeastward over France and Spain on the 26th. By 1800 it was over the Gulf of Lyon, where the first ship reported gales. By noon on the 27th it had swept to Algeria and Sicily. Several French ships whose call letters could not be identified had winds near 40 kn and waves of 8 to 12 ft. On the 28th the front lost its punch and all winds reported were below gale force.

This storm was a combination of two LOWs. One came out of the southeastern United States and moved up the coast. The other came across James Bay and eastern Canada. On the 26th the EXPORT PATRIOT off Long Island had 39-kn gales. On the 27th the SCOTSTOUN was south of Long Island with 35-kn gales.
On the 28th the Canadian LOW took over, and the WVFN (a good reporter who could not be identified) at 47°N, 49°W, had 40-kn southeasterly winds. The OCEAN GOLF (38°N, 56°W) measured 41-kn southerly winds and 20-ft waves. The storm was 986 mb near Corner Brook. On the 29th the SIR HUMPHREY GILBERT at Hamilton Inlet had 40-kn winds out of the north. The storm center continued northeastward and broke up on Kap Farvel on July 1.

Casualties--The 9,110-ton American JOHN TYLER sustained heavy-weather damage on the 2d. The Swedish 8,920-ton roll on-roll off ferry developed a serious list in heavy weather off Cyprus after seizure of the automatic pilot in hard-to-starboard position. The vessel later capsized and sank on the 7th. The 378-ton Swedish tanker FURENAS and the 1,580-ton Danish ferry KARNAN collided in dense fog on the 3d outside Helsingborg. There were no injuries. Early in the month the 4,971-ton FLENSAW struck the No. 3 lock in the Welland Canal during a violent rainstorm and strong wind gusts.

On the 11th the 200-ton British QUEENFORD and the 1,833-ton Greek IRENES SUN collided in heavy fog in the North Sea. The QUEENFORD sank but her crew

of three was saved. The Greek GEORGE B. SPHIKAS requested heavy-weather damage survey at Naples on the 12th. The 10,009-ton ARISTEUS and the 86,098-ton NORDIC CRUSADER collided in fog in the North Sea on the 12th. The 1,587-ton ARGO GLORY had heavy-weather damage on a voyage from New Orleans to Port of Spain. The 4,735-ton Panamanian FAIR REEFER suffered heavy-weather damage on a voyage to Poland on June 20 to 22.

The two Canadian lakers ALGOBAY (22,850 tons) and the MONTREALAIS (17,647 tons) collided in fog on the St. Clair River on the 25th. The 16,628-ton HILDA MARJANNE had her ice-damaged propeller blades replaced at Port Colborne this month.

Other Casualties--The Liberian tanker BILBAO encountered heavy weather during June 5 to 22 from Iraq to Portugal. The Greek bulkcarrier APOSTOLOS ANDREAS and the tanker ZAKYNTHOS collided in fog at San Vicente on the 12th.

Smooth Log, North Pacific Weather

May and June 1980

SMOOTH LOG, MAY 1980--May was a relatively pacific month on the North Pacific. The storms were not so severe, and their number was limited. There were two primary storm tracks. One was from Hokkaido to the Pribilof Islands and the other from Honshu to Bristol Bay. Three storms crossed the Gulf of Alaska. The primary difference from climatology was that the storms ended over the eastern Bering Sea rather than in the Gulf of Alaska.

The mean sea-level pressure was more intense than the long-range normal. The Aleutian Low was one 1000-mb center near 55°N, 175°W, rather than three 1009-mb Lows stretched across the Bering Sea. The Pacific High was 1028 mb near 34°N, 145°W, 5 mb higher than normal, but very near its normal location (fig. 30).

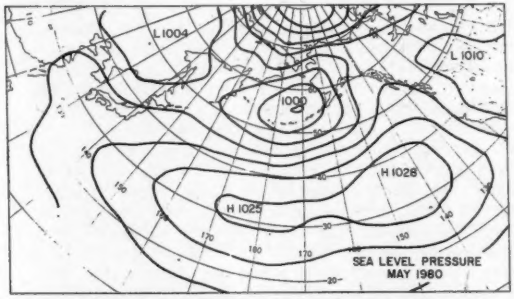


Figure 30.--Mean sea-level pressure.

The anomaly centers closely matched the pressure centers. A minus 10 mb was near 56°N, 172°W, and a plus 5 mb was near 39°N, 145°W. There was a second plus 5-mb center near 34°N, 170°E, associated with a secondary Pacific High center. Although not directly affecting this ocean's weather, the pressure of the Polar High at 1032 mb was 11 mb above the climatic mean.

The upper air flow at 700 mb was mainly zonal between 35° and 50°N. Over the Gulf of Alaska it was southerly. The long-wave Low was centered almost directly over the surface Low at 2,802 m or 88 m lower than normal. The main High center was 3,203 m and west of the date line rather than east of it.

There were two typhoons, Dom and Ellen, and tropical storms Forrest and Georgia this month.

Extratropical Cyclones--The first storm of the month was east of Tokyo on the 1st. There already were gales, and a ship at 37°N, 144°E, had northeasterly winds of 46 kn. A ship closer to the center of the LOW had 26-ft swells. On the 2d the ASIA BRAVERY (42°N, 153°E) was 200 mi north of the storm with 48-kn winds. At 0600 on the 3d the PRESIDENT JACKSON was 450 mi east-southeast of the 988-mb storm with 36-ft seas. On the 4th the waves were still 28 ft. At 0000 that day the storm was near 47°N, 175°E. It was tracking more northward on the 4th. On the 5th a German ship at 53°N, 175°E, reported 50-kn winds with 40-ft swells. Late that day the storm weakened rapidly and was gone by the 6th.

This was a strong storm over Manchuria on the 4th, but it weakened as it approached the coast. At 0000 on the 6th it was over Honshu. At 1200 the NORSE PILOT was near the cold front with 33-ft swell waves. By the 7th the storm was again intensifying. The DIANA at 40°N, 154°E, and the KISO MARU near 37°N, 153°E, both had 52-kn winds from the east and north, respectively. At 0000 on the 8th the 993-mb storm was near 44°N, 172°E. Several ships continued to report winds between 40 and 50 kn. At 2200 the HANJIN INCHEON took a special observation to record 26-ft swells near 53°N, 166°W. On the 9th she was measuring 40-kn winds with 36-ft swells near 51°N, 177°W.

The storm was 972 mb near the Pribilof Islands on the 10th, but the winds were mostly less than gale force. The CRYSTAL STAR was south of the Aleutians on the 10th and 11th measuring winds near 40 kn, but she was being pounded by 33-ft swell waves. Another storm was approaching from the southwest and absorbing the energy and circulation.

A cyclonic circulation developed on the 9th over the northern Sea of Japan between two other LOWs to the north and south. By the 10th the new circulation was the only one left of the three. A Soviet ship near 50°N, 160°E, had 52-kn winds with 28-ft seas. On the 11th the higher winds were in the 40-kn range with waves up to 26 ft. At 0000 on the 12th the 976-mb storm was north of Atka Island. The strongest wind on the analysis was 40 kn from Cold Bay. The CRYSTAL STAR now had 25-ft waves with this storm. On the 13th the storm was beginning to weaken, but the ALAIN L.D. (54°N, 158°W) found 43-kn winds and 16-ft seas. The storm had dissipated by the 15th.

This was one of two storms that formed south of the Gulf of Alaska and traveled northward. Within hours

of its formation on the 14th, the PRESIDENT TYLER had 45-kn winds. The storm was 980 mb by 1200 on the 15th near 49°N, 151°W. A ship within 1 mb of the center had 50-kn southerly winds. The PRESIDENT TYLER still measured 45-kn winds with 30-ft seas and 33-ft swells.

Two ships had winds near 60 kn on the 16th. One was the VAN CONQUEROR near 51°N, 152°W, and the other SHIP was near 51°N, 159°W. On the 17th the VAN CONQUEROR was still reporting 52-kn winds and several ships had waves up to 25 and 30 ft. The LOW was absorbed by the next storm on the 18th.

Monster of the Month--This storm raced from the Yellow Sea to Kamchatka in less than 2 days. It traveled the Great Circle track from Korea to Oregon. At 0000 on the 16th it was 972 mb near 54°N, 155°E. The storm brought heavy rains to the Japanese Islands with a maximum of 95 mm (3.7 in) being reported. Newspapers reported 45-kn winds over the Sea of Japan. Thunderstorms formed along the front. It was during this storm that the AMOCO SEAFARER and CELEBRATION VENTURE collided near Osaka. The 1,622-ton NITTAN MARU and the 699-ton HOKUTO MARU collided in fog south of Ube Cape. There were no casualties among either crew. The KOEI MARU grounded. The weather forced the cancellations of 64 scheduled domestic aircraft flights. Ships near the Kurile Islands had gales. The CRYSTAL STAR (49°N, 155°E) found 44-kn winds and 25-ft swell waves. The JMMY (52°N, 166°E) was buffeted by 56-kn winds and 23-ft seas. The storm was raking the Bering Sea on the 17th with a central pressure of 956 mb. The JUNEAU MARU (52°N, 168°E) found 56-kn winds and 33-ft waves, while the PRESIDENT PIERCE (54°N, 175°E) was suffering only 35-kn gales with 30-ft waves. Others were suffering up to and including storm force.

The storm was producing gales and strong gales on the 18th. The STUYVESANT (60°N, 145°W) was south of Hinchinbrook Island with 45-kn winds from the southeast and 30-ft waves. The GLACIER BAY at 43°N, 153°W, was far to the south near the cold front with 40-kn winds and 21-ft waves. The SINCERE No. 3 at 46°N, 173°W, reported swell waves of 39 ft at 1800.

The storm crossed the Alaska peninsula and moved into the Gulf of Alaska on the 19th. The winds remained mostly gales with waves up to 25 ft. The exception was the GRAND GLOBE (52°N, 179°E) in the dangerous southwest quadrant, where she was hit with 58-kn winds from the west. She probably came under the influence of an area of positive vorticity advection in the upper air, which would increase the instability. The storm was weakening as it approached the coast. Far to the south (39°N, 155°W) and closer to the Pacific High than the LOW, the NEW GOLDEN PHOENIX found 45-kn winds. When the LOW moved ashore on the 23d, it was only a bubble in the analysis.

This was a fast developing storm. It had its roots in an inverted trough southwest of and between two cells of the Pacific High. Normal observations from two ships identified the formation of the frontal wave on the 1200 analysis of the 18th. Twelve hours later it was a full-grown cyclone. At 1200 on the 19th the 996-mb storm was near 44°N, 163°E. The CHIN CHING was within 100 mi of the center with 26-ft swell waves. By 0600 on the 20th her winds had increased to 44 kn with 25-ft waves. The diameter of this storm was small and remained small. On the 23d the storm was traveling along the Alaska peninsula and pushing against a large Pacific High that extended into Alaska. The HIGH won on the 25th.

This was the extratropical continuation of typhoon Ellen. She turned extratropical late on the 21st east of northern Honshu and brought gales to ships in the area. A Japanese ship had 49-kn winds and 20-ft waves west of the center. On the 23d the NIPPO MARU southwest of the 976-mb center found 48 kn with 16-ft waves, while the TOYOTA MARU No. 1 was fighting only 40-kn southerly winds, but the swell waves were pounding her 30-ft line southeast of the center.

At 0000 on the 24th the 972-mb storm was at 51°N, 168°E. The PRESIDENT ADAMS was in the western outskirts of the storm near 50°N, 156°E, with 60-kn northerly winds and 23-ft seas. The storm spread its area of influence late on the 24th as a LOW over the Alaska peninsula was dying. The NEW GOLDEN PHOENIX (41°N, 168°E) was involved with this storm to the tune of 55 kn. The center was traveling along the Aleutians. On the 26th it was moving northward over the Bering Sea to dissipate.

The last storm of the month formed over the Yellow Sea prior to the 0000 analysis of the 25th. It moved northeastward across the western Sea of Japan and then northward over the continent. It was bringing gales to the Sea of Japan on the 26th. The outer reaches of the storm were bringing winds over 40 kn east of Honshu. On the 27th the SHINZUI MARU (47°N, 157°E) and a Soviet ship, UUEJ (50°N, 155°E) had 55-kn winds from the southeast. Swell waves over 20 ft were being observed by other ships. The storm's center was on the western shore of the Sea of Okhotsk.

By the 28th the stronger outer fringes of the storm had retreated west of the Kurile Islands. On the 29th the storm broke up into multiple centers.

Tropical Cyclones, Western Pacific--Typhoon Dom formed in the southern Philippine Sea on the 9th. Heading west-northwestward, he reached tropical-storm strength on the 11th, shortly before crossing the 130th meridian near 12°N. As Dom approached the east coast of Luzon, he began recurving northward and gained typhoon status. Maximum winds reached 85 kn on the 13th as Dom brushed the Luzon coast. This encounter weakened the storm, and by the 15th he was a tropical storm heading northward. A day later Dom began turning toward the east. He regained typhoon strength for a few hours on the 17th, but weakened again. By late on the 19th, after recrossing the 130th meridian this time near 20°N, Dom fell to depression

strength.

While Dom was buffeting Luzon on the 13th typhoon Ellen was coming to life among the Caroline Islands, just southeast of where Dom had formed. Ellen took a north-northwesterly track. She quickly reached typhoon intensity before crossing the 10th parallel near 142°E on the 15th. By the following day maximum winds climbed to 110 kn with gusts estimated at 135 kn. Ellen maintained this intensity into the 18th, remaining well west of the Mariana Islands. On the 20th, with 85-kn winds, she shifted to a more northerly course and accelerated. The following day winds fell to tropical-storm strength, and the storm turned east-northeastward after crossing 30°N near 137°E. This turn prevented Ellen from hitting Honshu. She continued to weaken rapidly.

About the time that Ellen was threatening Japan, tropical storms Forrest and Georgia were coming to life farther south. Forrest developed on the 19th in the Caroline chain, just west of Truk Island, while Georgia came to life in the South China Sea, near 15°N, that same day. Forrest headed west-northwestward, while Georgia took a northerly track. Forrest's maximum winds climbed to about 55 kn on the 24th shortly before he crossed the Philippines. The following day he made his way across central Luzon and into the South China Sea. He dissipated near 20°N, 115°W, an area crossed by Georgia just 3 days earlier.

Georgia had developed off the remains of a cold front that had passed through Hong Kong on the 15th. She attained tropical-storm strength on the 22d, some 340 mi south-southeast of Hong Kong. Late in the day 50-kn winds were blowing around her 987-mb center. Early on the 23d Georgia turned onto a north-northeasterly track at 11 kn. The CHEVALIER PAUL encountered 54-kn winds 60 mi to the west of Georgia's center, while the CLARA MAERSK reported 50-kn winds some 55 mi to the northwest. The weather radar at Hong Kong's Royal Observatory indicated heavy spiral bands to the east of the center, but little rain to the west. Georgia continued to move towards Shantou. She passed 90 mi east-southeast of Hong Kong late on the 23d. Early the next morning Georgia passed close to Shantou, where a minimum sea-level pressure of 990.2 mb and maximum peak gusts of 68 kn were reported. The highest sustained wind observed by a land station was 44 kn in Kinmen. In Hong Kong gales were experienced offshore and on hilltops during the afternoon of the 23d. Gusts in the area ranged from 25 to 73 kn, mainly out of the north-northeast through east. (This preliminary report on Georgia was furnished courtesy of Director, Royal Observatory, Hong Kong.)

Casualties--It wasn't until the 15th that a weather casualty was reported. Early that morning the 140,206-ton AMOCO SEAFARER and the 38,142-ton CELEBRATION VENTURE collided in rough seas in Kii channel near Osaka. Both vessels suffered damage. A few hours later the 498-ton KOEI MARU No. 5 grounded in rough seas off Shimotsu. On the 19th the 44,708-ton tanker AVRA was at Sasebo with heavy-weather damage.

Before dawn on the 22d the 10,224-ton ZENLIN GLORY sank after a collision with the 9,154-ton SEAWAY DISPATCH in fog in the Tsugaru Strait. The 21,475-ton PRESIDENT PIERCE requested a heavy-weather survey at Yokohama on the 23d. The 5,103-ton ZEPHUNTER requested a heavy weather damage survey on arrival at Osaka.

Other Casualties--The Indonesian ferry SAMUDERA INDAH sank on the 22d during a storm with 14-ft waves between the islands of Lombok and Sumbawa. Forty-four passengers were rescued, but 49 were feared dead.

SMOOTH LOG, JUNE 1980--Severe storms were few and far between this month. There were many short-lived frontal waves which are not pictured on the monthly cyclone track chart. The major path of cyclones this month was an anomalous one from the west shore of the Sea of Japan and along the western Bering Sea. Some storms developed off Honshu that traveled east to northeast and generally dissipated over midocean. Farther to the east in the vicinity of 45°N, 170°W, storms developed that moved northeastward toward Bristol Bay.

The mean sea-level pressure pattern was completely dominated by the 1030-mb Pacific High centered near 40°N, 150°W. There was no indication of an Aleutian Low. There was a 1005-mb low center over eastern Siberia and a 1013-mb low center over the Yukon. Climatology indicates a 1010-mb Aleutian Low north of Adak Island and a 1011-mb LOW over Alaska. The Pacific High is normally 1024 mb (fig. 31).

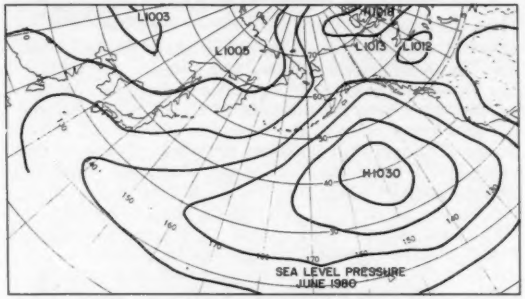


Figure 31.--Mean sea-level pressure.

The anomaly pattern was dominated by a plus 11-mb center near 46°N, 160°W. Most of the North Pacific north of latitude 20°N had pressure above normal. The only negative anomaly center was minus 5 mb over eastern Siberia.

In the upper air at 700 mb the pressure level was higher than normal in general. A trough with a weak LOW supported the surface LOW over Siberia. The height 600 mi south of the Alaska Peninsula was up to 400 ft above normal.

There were four tropical cyclones: tropical storm Herbert over the western ocean and hurricanes Agatha and Celia and tropical storm Blas over the eastern ocean.

Extratropical Cyclones--The Pacific High was one of the primary controlling factors in the tracks of the cyclones. The HIGH started the month off the U.S. West Coast. Toward the end of the first week, it weakened temporarily. During the second week it elongated east-west, and by the third week it was in place over the central ocean. It then drifted and built eastward and was again off the U.S. West Coast on the fourth week.

The first gales were associated more with the Pacific

High than the LOW, which was inland over the Rocky Mountains. One of the first reports was by the PRINCE WILLIAM SOUND, which measured 45-kn winds and 13-ft waves off Cape Mendocino, Calif., on the 1st. On the 2d the OGDEN FRASER found 35-kn northwesterly winds off Vancouver Island, and the MOBILE MERIDIAN near San Francisco measured 38-kn winds and 15-ft seas. On the 3d the SPRAY CAP reported 50-kn winds south of Cape Blanco. The OGDEN FRASER was sailing northward and found 43-kn gales west of the Queen Charlotte Islands. The gradient relaxed on the 4th.

A frontal system moved eastward across Japan on the 3d. By 1200 on the 4th a new circulation had formed around the occlusion and was near 44°N, 165°E. The PACHACHA (35°N, 171°E) had southerly 45-kn winds. Another ship with the call letters BPLI estimated the winds as 41 kn near 36°N, 163°E. This one spurt of energy seemed to be all the storm contained, and it steadily weakened.

The junction of the Amur and Zeya Rivers was the birthplace of this storm. It moved over the Sea of Okhotsk on the 8th and the Kamchatka Peninsula on the 9th. At 0000 on the 10th the LOW was 998 mb near 52°N, 165°E. The SPRAY CAP was near 49°N, 167°E, with less than 1/2-mi visibility and 47-kn southwesterly winds. The waves were 15 ft. The system was traveling eastward at 25 kn. The KOULOUNDA (54°N, 161°W) northeast of the center had 52-kn winds from the southwest. On the 12th the storm was moving into the Gulf of Alaska. The ROKKOHSAN MARU and the H8DE, both near 53°N, 150°W had 35- and 40-kn winds, respectively. Late on the 13th two U.S.S.R. ships, probably fishing vessels, were near 54°N, 161°W, with gales. The storm stalled on the 13th and 14th near 58°N, 145°W. There were 30- to 40-kn winds along the Alaska Peninsula as reported by the AMERICAN VIKING, GAIL WIND, and WALTER N. The fishing vessel MICHAEL LEE sank near Port Moller, where the WALTER N. reported 30 kn. It was not specified if weather was a factor. The storm began moving southward on the 15th and faded from the scene.

This was one of the storms that formed off Honshu, but it was not typical in that it moved more northward than the majority. It was first detected on the 10th. The NEW GOLDEN PHOENIX (45°N, 162°E) was north of the storm on the 11th and found easterly 50-kn winds most of the day. At 0000 on the 12th the storm was near 53°N, 156°E, at 984 mb. The OGDEN FRASER was about 400 mi southwest of the center with 45-kn winds from the north. On the 13th the BELLMAN found 48-kn winds. A U.S. ship southeast of Adak Island on the 14th had 37-kn winds, and the fishing vessel WENDY FOSS had southeasterly winds of 40 kn near Dutch Harbor late in the day. On the 15th the storm turned westward toward Kamchatka. The front stretched far to the east, and the CALEDONIAN FOREST found 54-kn southerly winds at 50°N, 164°W, near the front. The HANJIN INCHEON (51°N, 168°W) reported swell waves of 30 ft. On the 16th the LOW disappeared.

This storm came out of Manchuria. On the 18th it was 989 mb south of the eastern tip of Hokkaido. The first gales were found by Soviet fishing vessels off Ostrov Kunashir, and the PRESIDENT PIERCE south of Osaka estimated the winds at 50 kn with waves of 18 ft. On the 19th the storm was moving northeastward as it was deflected by the Pacific High over midocean. Four ships west, south, and east of the center found gales. The gradient was tightest south and east of the front. A ship slightly south of the cold front near 36°N, 156°E, had 25-ft waves. The storm's influence was reaching eastward along the Aleutians. Bethel and Cold Bay had 46-kn winds. The OREGON (56°N, 170°W) had 40- to 50-kn winds with heavy rain and 1/2-mi visibility. Others were reporting 30- to 45-kn winds. The UNITED SPIRIT had 40-kn winds on the 20th near Adak Island. The SINCERE No. 3 measured only 30-kn winds, but the sea and swell waves were 25 ft. On the 20th the storm moved through the Bering Strait.

As the point of occlusion of the front from the storm above moved eastward across the Alaska Peninsula, a LOW formed. Gales started blowing late on the 22d. The SUNNY WEALTH (52°N, 149°W) was about 300 mi south of the 991-mb center with 45-kn winds. Six hours later the TOZAN MARU brought 42 kn into the game. At 1200 the THOMAS G. THOMPSON reported 40 kn, while only a few miles from OWS Papa who was reporting 36 kn and 16-ft waves.

The storm was traveling southeastward off the British Columbia coast on the northeast side of the Pacific High and weakening.

The front from the storm above divided the Pacific High into two cells near midocean. A frontal wave formed on the front in the inverted trough south of the high pressure on the 21st. It broke through the two high cells on the 22d and raced northward. At 0000 on the 24th the small storm was near Unimak Island at 999 mb. Another frontal wave had developed southwest of this one and was following in its tracks. At 0600 the PRESIDENT TYLER (47°N, 168°W) measured 49-kn winds in the southwesterly flow east of the second frontal wave. At 1800 a SHIP near 46°N, 162°W, had 40-kn winds. Late on the 24th the two LOWs combined forces, and the first observation on the 25th showed waves of 26 ft. The PACBARONESS at 54°N, 153°W, found 47-kn winds on the 26th. The storm disappeared over the Alaska Range on the 27th.

This storm was exported out of a port on the Yellow Sea. The NEW GOLDEN PHOENIX was in the Sea of Japan with 35 kn out of the northwest on the 26th. The storm moved across Honshu and was near 40°N, 151°E, at 1200 on the 28th at 990 mb. The circulation had spread and consolidated. Several ships, including the CANADA MARU and the FORT NELSON, found gales both west and east of the center. Waves of 13 ft were the highest reported. On the 29th the EASTERN RIVER (40°N, 151°E) had 40-kn winds. The SOUTHERN HIGHWAY had 16-ft waves 300 mi south of the center. Isolated gales continued into the 30th, but the storm died by July 1.

Tropical Cyclones, Eastern Pacific--Hurricane Agatha came to life on the 9th about 150 mi southwest of Clipperton Island. Heading slowly northwestward, she intensified to tropical-storm strength late in the day and became a hurricane the following day. Agatha intensified slowly. By the 11th, after crossing the 10th parallel near 115°E, winds climbed to 85 kn near her cen-

ter. Early on the 12th they were up to an estimated 100 kn. Gales extended 150 mi in all directions. This was Agatha's peak. She began turning west-northwestward and by the 13th had moved into a region of relatively cool water. Sea-surface temperatures ran about 75°F and satellite photos showed weakening. She had dropped to tropical-storm strength before the day was out. Agatha dissipated on the 15th west of 135°W and south of 20°N.

While Agatha was falling apart in midocean, tropical storm Blas was coming together just north of Clipperton Island. By 0000 on the 17th the tropical storm was centered near 12.3°N, 110.5°W. Heading northwestward, under the watchful eye of the Eastern Pacific Hurricane Center, Blas reached peak intensity on the 18th. Maximum sustained winds climbed to 45 kn. It was not until late that same day that the slow-moving storm crossed the 15th parallel, near 115°W. The following day he weakened to a depression.

Toward the end of the month hurricane Celia popped up some 450 mi southeast of Manzanillo. Moving westward on the 25th, Celia became a tropical storm. The EXXON NORTH SLOPE (17°N, 102°W) had 45-kn gales and 17-ft waves. The following day, near 15°N, 108°W, she attained hurricane status. She also made a fatal error by turning toward the west-northwest. She headed for an area of increasing wind shear and cooler water. Celia remained a minimal hurricane until the 28th. Late in the day she came under the influence of an upper level trough. Quickly she lost all upper level support. She dissipated by the 30th.

Tropical Cyclones, Western Pacific--Tropical Storm Herbert originated about 650 mi south of Hong Kong on the 24th. After moving rapidly toward Vietnam he gradually slowed and turned northwestward. Herbert reached tropical-storm strength early on the 25th. Later in the day a reconnaissance plane reported 45-kn surface winds around a 992-mb pressure center. Herbert's center passed over the Paracel Islands between Xishadao and Sanhudao on the 26th. Winds at the time were 42 kn with gusts to 62 kn. The storm intensified slightly after passing the Paracels on a northwestward track. However, Herbert weakened after crossing Hainan late on the 26th. Once in the Gulf of Tonkin he began to turn westward just before reaching the south China coast on the 28th. Late that afternoon he moved ashore about 110 mi east-northeast of Hanoi.

Casualties--The Japanese ferry FERRY AKASAI for Kobe grounded in fog on the 2d. That same day the 870-ton Korean DONG IL sank off Numodari Hana after a collision in fog with the Japanese 451-ton SETOUCHI MARU, which rescued the crew. On the 8th the KYUDAI MARU and the DONG JIN No. 11 collided in fog 36 mi north of Cheju Island. The TOYO MARU No. 16 laden with 258 Mazda cars collided in fog with the NICHIWA MARU with 538 Datsun cars off Cape Kajetori on the 10th. The TOYO sank and the crew of 11 were rescued by the NICHIWA. Fog was still the culprit. The TAIHEI MARU and KUNITOMO MARU collided in dense fog off Komatsushima on the 16th.

The 8,566-ton PRINSENDAM was at Vancouver on the 17th to have ice damage repaired which occurred in Glacier Bay on a voyage from Vancouver to Alaska. Two South Korean hydrofoil passenger vessels, the ANGEL No. 1 and ANGEL No. 2, collided in fog in Chinhae Bay on the 24th. At least four passengers died with many including crew injured. The TOHO MARU No. 13 and the GALLEON ONYX collided in fog off Hokkaido. The TOYO MARU capsized and four of eight crewmen were rescued.

The American tanker WILLIAMSBURGH sustained heavy-weather damage during June 19 to July 1. The GRAND ZODIAC had heavy-weather damage on a voyage from Coos Bay for Japan. The container vessel SUNSHINE ISLAND encountered heavy weather in June from Pusan to the United States and lost containers overboard.

Other Casualties--The Liberian BELLA (9,287 tons) had damage from a cargo of logs, part of which broke adrift in heavy weather in the Indian Ocean on June 3 to 9. The 32,360-ton SAUDI-FILIPINAS 1 sank in the Indian Ocean on the 9th while under tow by the tug SUMATRAS in force 9 to 10 winds. The Greek SUNRISE diverted to Bombay owing to water in the engineroom from heavy weather. The 11,207-ton VILLANGER developed a list of 12° during bad weather off Chile on the 14th.

The Panamanian GOLFE DE TADJOURAH struck rocks and grounded on the 11th near the Oman coast in poor visibility and rough seas. Eleven of the 16 crew survived.

The 11,188-ton American SANTA MARIANA alleged weather damage on the 15th and 16th from Buenos Aires to Valparaiso. The ERSKINE BRIDGE reported the flukes and swivel of the starboard anchor were damaged on the 18th off Port Kembla because of heavy seas.

The BARON WEMYISS, a British bulkcarrier arrived Auckland on the 22d as a port of refuge following water ingress during heavy weather. On the 23d the PING CHAU and the HADI contacted during heavy weather while at anchor at Bombay. The Singapore CHERRY MAJU grounded at the port of Karwar, India, with large list. All the crew were rescued, but monsoon weather prevented reboarding.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

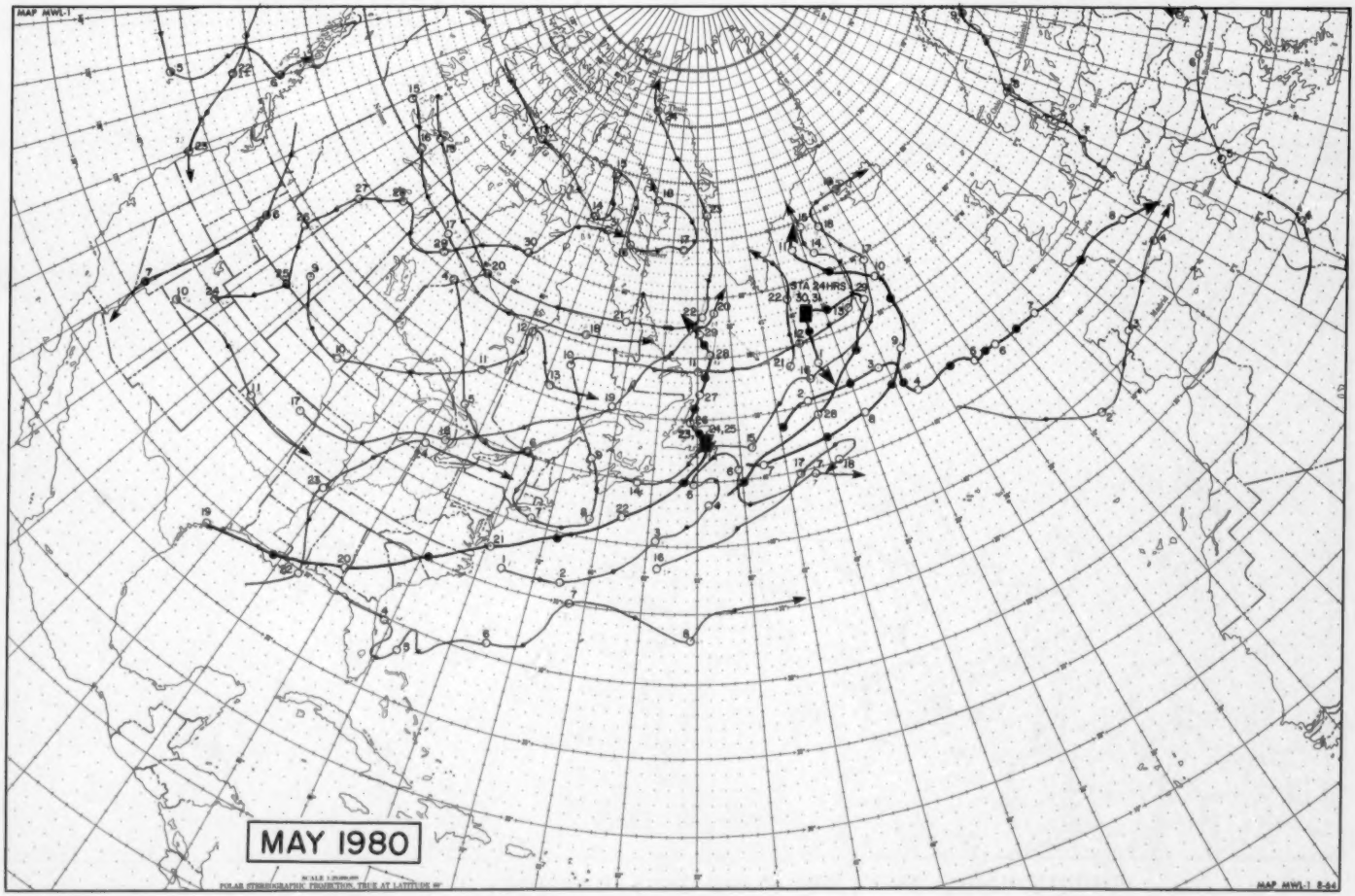


Figure 32. -- Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

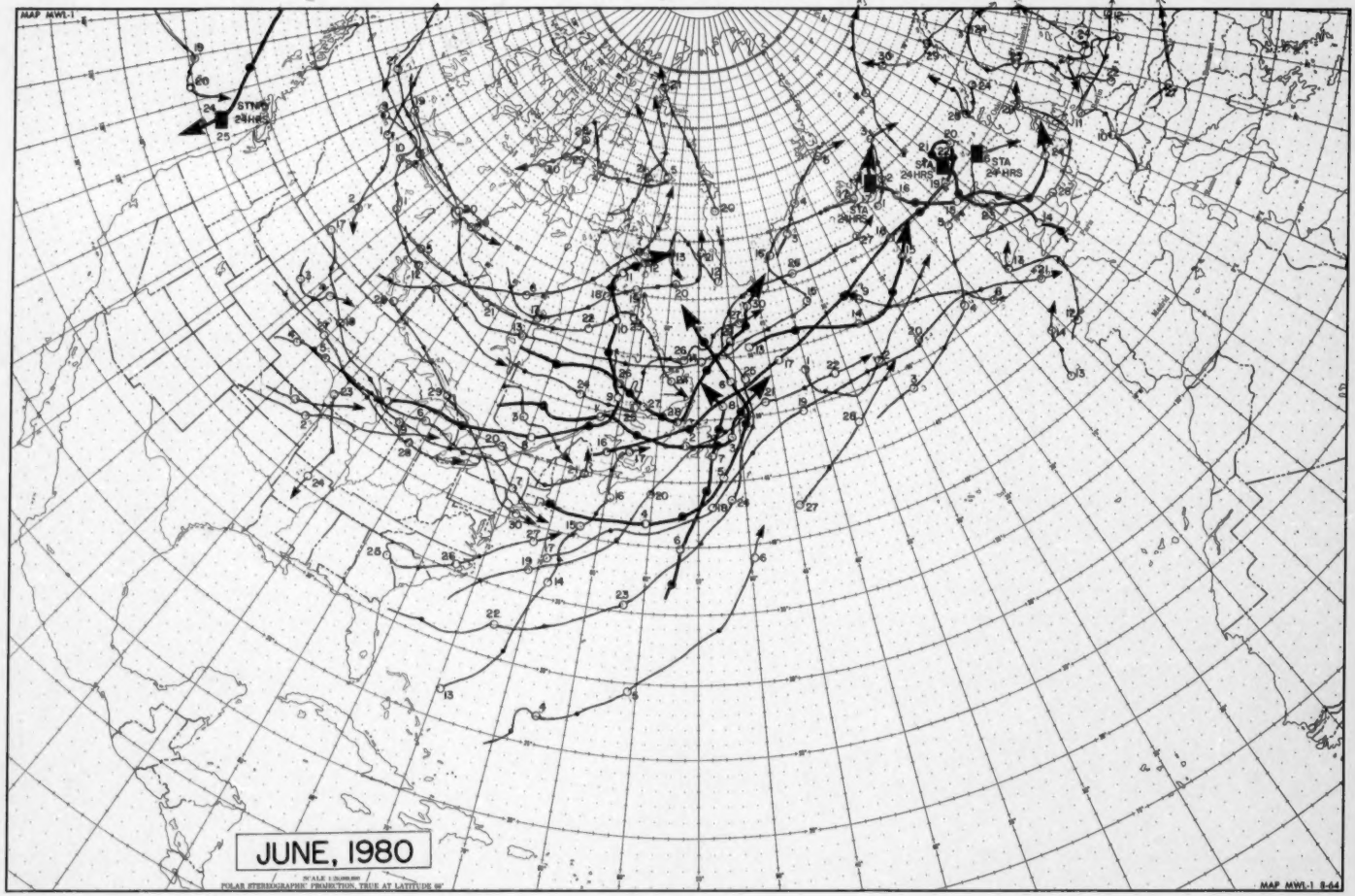


Figure 33. -- Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

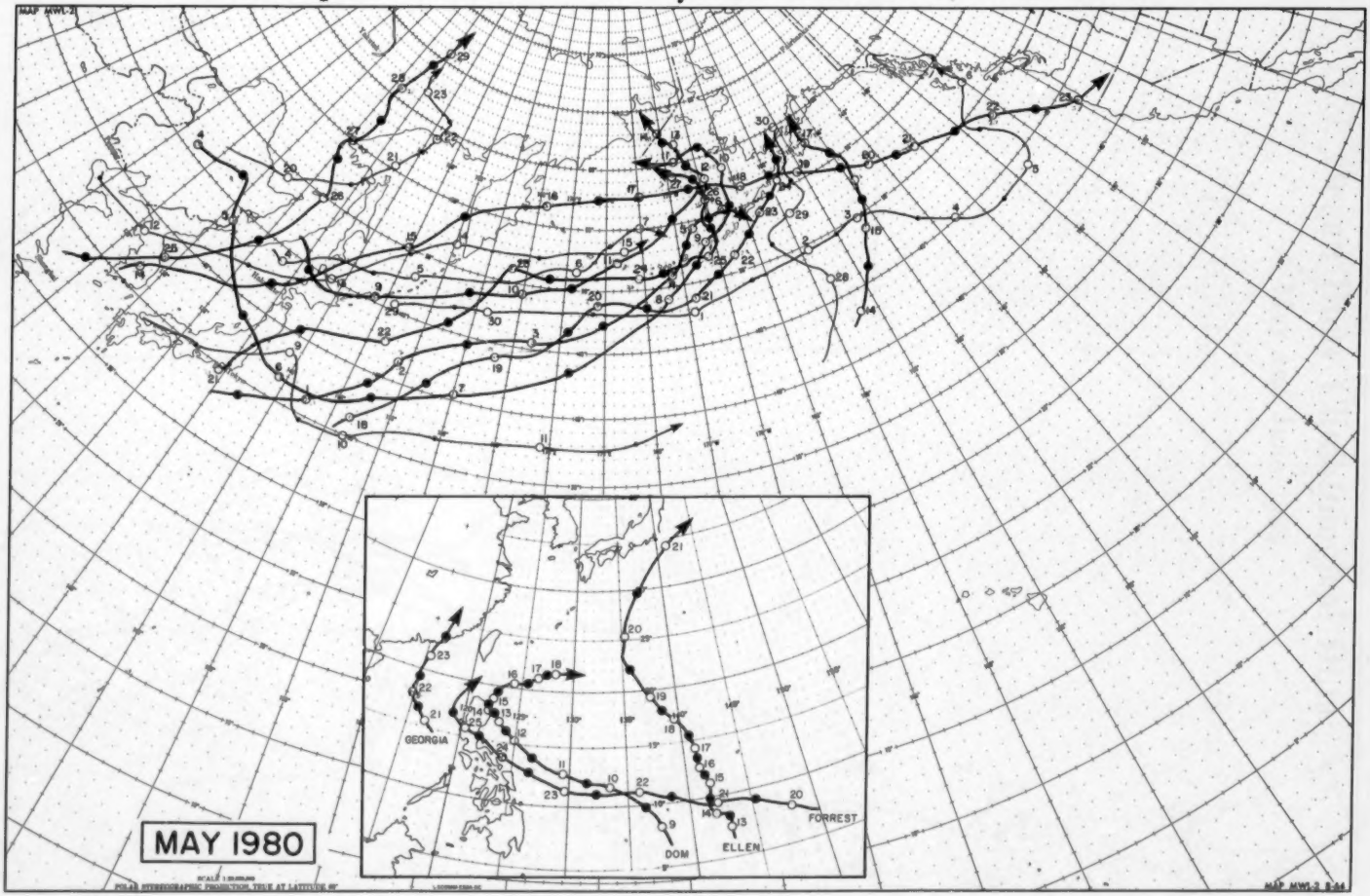


Figure 34. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

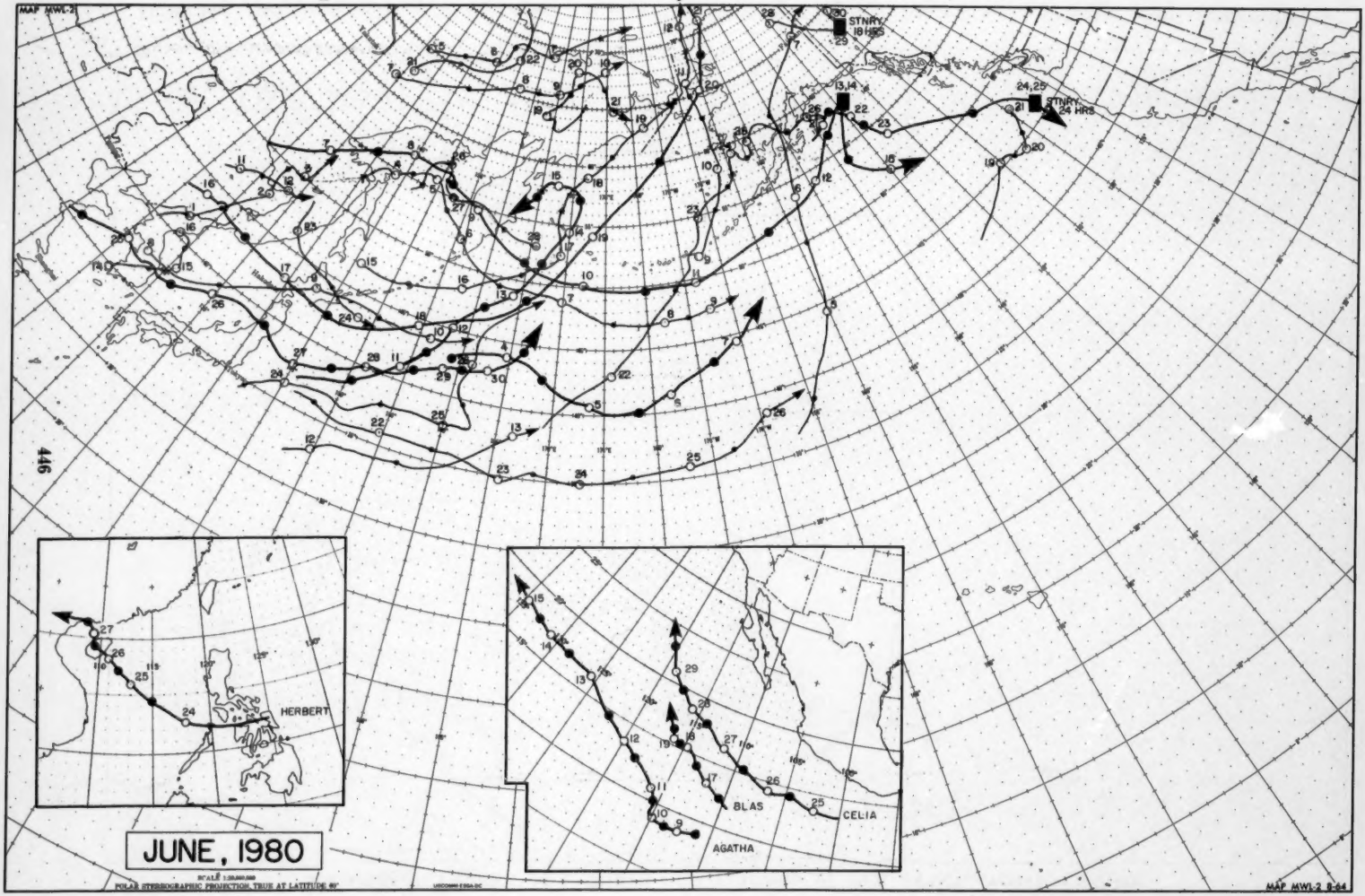


Figure 35. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

U.S. Ocean Buoy Climatological Data

May and June 1980

MAY — DATA SUMMARY — 41001

AVERAGE LATITUDE 34.7N — AVERAGE LONGITUDE 072.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.4	(10 06)	20.1	23.1	(29 15)	245	31
SEA TEMP (DEG C)	19.6	(17 12)	20.7	22.2	(29 21)	247	31
AIR-SEA TEMP (DEG C)	-09.7	(10 09)	-00.7	01.9	(29 15)	245	31
PRESSURE (MBAR)	1000.4	(25 21)	1015.2	1029.9	(17 15)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	MEAN SPEED (KNOTS)	TOTAL %
N	1.2	2.6	8.9	.4			13.4	13.4
NE		.8	4.0	.8			9.7	15.2
E	.4	1.6	2.4				9.5	11.0
SE		2.0	1.6				7.6	11.8
S	.6	7.7	12.1	.8			21.5	11.8
SW	.4	5.3	22.7				20.3	14.2
W	.6	3.2	7.3	.8			12.1	12.6
NW	.8	2.8	9.9	2.0			10.5	14.6
CALM	.4						.4	.0
TOTAL	4.9	26.3	69.0	4.9			100.0	13.3

NO. OF OBS: 247

MAX WIND SPEED: 27 KNOTS DIRECTION: 260 DEG DAY: 01 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 245

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	21.6	58.0	18.4	2.0					1.3M	3.0M (21 15)

JUNE — DATA SUMMARY — 41001

AVERAGE LATITUDE 34.7N — AVERAGE LONGITUDE 072.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.6	(14 00)	21.9	24.6	(30 18)	239	30
SEA TEMP (DEG C)	20.9	(06 09)	21.9	23.3	(29 21)	238	30
AIR-SEA TEMP (DEG C)	-02.8	(14 00)	-00.6	03.6	(27 15)	238	30
PRESSURE (MBAR)	1008.2	(09 03)	1017.8	1024.4	(24 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	MEAN SPEED (KNOTS)	TOTAL %
N	.4	2.9	10.0	.4			13.8	14.6
NE	.8	2.9	4.6	3.7			10.8	14.3
E		2.9	1.7				9.6	11.1
SE		2.1	3.3	.4			9.9	13.2
S	.4	7.9	22.2	4.2			24.7	14.8
SW		2.9	18.0	1.7			22.6	15.6
W			.4				.8	14.5
NW	.8	2.9	2.5				6.3	9.7
CALM	1.2						1.3	.0
TOTAL	3.8	24.7	63.2	8.4			100.0	14.1

NO. OF OBS: 239

MAX WIND SPEED: 24 KNOTS DIRECTION: 200 DEG DAY: 08 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	6.3	61.9	27.6	4.2					1.3M	3.5M (30 21)

MAY — DATA SUMMARY — 41002

AVERAGE LATITUDE 32.3N — AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.1	(09 18)	22.0	26.0	(29 15)	248	31
SEA TEMP (DEG C)	21.1	(01 18)	23.1	25.2	(22 21)	248	31
AIR-SEA TEMP (DEG C)	-05.6	(09 18)	-01.0	01.7	(29 15)	248	31
PRESSURE (MBAR)	0999.7	(26 09)	1014.4	1025.1	(17 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	MEAN SPEED (KNOTS)	TOTAL %
N	.8	.8	3.6				5.2	11.0
NE	.4	.8	5.6	2.8			9.9	14.8
E		4.0	2.8				6.9	11.0
SE	1.2	4.4	2.0				7.7	8.4
S	1.2	8.1	9.3	.4			19.8	10.1
SW	2.4	10.1	20.2	.4			33.1	11.2
W	.8	4.4	6.9	.4			12.5	12.5
NW	.4	.4	2.0	1.2			4.0	14.8
CALM	2.8						2.8	.0
TOTAL	10.1	33.1	52.4	4.4			100.0	11.4

NO. OF OBS: 248

MAX WIND SPEED: 27 KNOTS DIRECTION: 050 DEG DAY: 27 HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	14.1	46.1	18.1	1.6					1.3M	3.6M (27 06)

JUNE — DATA SUMMARY — 41002

AVERAGE LATITUDE 32.3N — AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.1	(19 12)	27.7	27.2	(30 21)	240	30
SEA TEMP (DEG C)	23.6	(16 17)	24.3	27.2	(30 21)	240	30
AIR-SEA TEMP (DEG C)	-02.6	(19 12)	-00.6	01.4	(27 06)	240	30
PRESSURE (MBAR)	1008.1	(09 06)	1016.5	1022.6	(06 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	MEAN SPEED (KNOTS)	TOTAL %
N	.4	.4	2.5	.4			3.8	12.5
NE	.4	4.6	10.4				13.4	15.8
E	.4	4.4	2.9				10.4	8.8
SE	2.1	7.1	4.2				14.2	9.2
S	.4	5.8	9.6	1.2			20.2	11.9
SW	.4	4.2	20.0	2.9			27.5	15.1
W	.4	2.1	2.9				5.4	10.4
NW		.4	3.7				4.2	11.8
CALM	.4						.4	.0
TOTAL	4.6	35.4	55.0	4.6			100.0	12.8

NO. OF OBS: 239

MAX WIND SPEED: 26 KNOTS DIRECTION: 190 DEG DAY: 26 HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	5.0	73.6	20.5	.8					1.4M	3.0M (24 21)

MAY — DATA SUMMARY — 41003

AVERAGE LATITUDE 3C.3N — AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.3	(09 18)	23.0	26.5	(21 00)	248	31
SEA TEMP (DEG C)	20.4	(01 21)	23.8	26.9	(21 21)	248	31
AIR-SEA TEMP (DEG C)	-05.4	(09 18)	-00.8	01.3	(21 00)	248	31
PRESSURE (MBAR)	1003.0	(26 09)	1014.5	1020.7	(31 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	MEAN SPEED (KNOTS)	TOTAL %
N		.4	3.6	2.8	1.2		8.1	11.7
NE		.4	2.4	3.2	.8		6.5	12.6
E		1.6	5.2	6.5			13.3	9.6
SE		1.6	6.9	8.1			16.5	9.7
S		.8	14.1	9.7			24.6	9.9
SW			4.4	2.4	1.2		8.5	12.5
W		.4	4.8	9.3	.4		14.9	12.5
NW		.4	1.2	3.2			4.8	10.3
CALM	2.8						2.8	.0
TOTAL	2.8	4.1	43.1	45.2	3.6		100.0	10.5

NO. OF OBS: 248

MAX WIND SPEED: 26 KNOTS DIRECTION: 210 DEG DAY: 26 HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	48.7	35.2	4.0						.9M	2.0M (31 21)

JUNE — DATA SUMMARY — 41003

AVERAGE LATITUDE 3C.3N — AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.7	(14 03)	25.8	27.9	(30 21)	240	30
SEA TEMP (DEG C)	24.2	(02 12)	24.4	28.2	(12 09)	240	30
AIR-SEA TEMP (DEG C)	-03.0	(20 04)	-00.6	01.0	(30 21)	240	30
PRESSURE (MBAR)	1010.4	(09 09)	1016.6	1021.4	(06 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	MEAN SPEED (KNOTS)	TOTAL %
N	1.2	2.5	.4				4.2	8.2
NE		.8	4.2	3.0			8.0	13.3
E			4.7	4.7			12.9	11.0
SE		.4	3.1	3.3			7.5	10.3
S		.4	8.1	15.0	.4		24.2	11.7
SW		.8	5.7	13.3	.4		20.4	12.4
W		.4	7.1	8.6	.4		16.7	11.2
NW			.8	.4			1.1	10.7
CALM	3.8						3.8	.0
TOTAL	5.0	3.8	33.7	2.1			100.0	10.9

NO. OF OBS: 240

MAX WIND SPEED: 24 KNOTS DIRECTION: 230 DEG DAY: 26 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	28.3	67.9	3.8						1.0M	2.5M (13 21)

MAY — DATA SUMMARY — 41004

AVERAGE LATITUDE 32.6N — AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.3	(16 00)	23.3	25.3	(31 21)	143	18
SEA TEMP (DEG C)	21.4	(18 09)	23.6	26.2	(28 21)	143	18
AIR-SEA TEMP (DEG C)	-04.1	(23 21)	-00.3	01.7	(20 21)	143	18
PRESSURE (MBAR)	1006.7	(25 21)	1019.8	1025.1	(17 15)	143	18

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	MEAN SPEED (KNOTS)	TOTAL %
N			1.4	3.5			4.9	13.6
NE		.7	1.4	7.7	1.4		11.2	15.6
E		.7	2.1	6.3	1.4		10.5	14.9
SE		4.2	4.9	4.2			13.3	7.2
S		2.8	9.1	13.3			25.2	9.5
SW		4.2	11.9	5.6			21.7	7.4
W		2.1	4.2	4.9			11.2	8.6
NW		1.4		.7			2.1	6.0
CALM								
TOTAL		16.1	33.2	46.2	2.8		100.0	10.2

NO. OF OBS: 143

MAX WIND SPEED: 23 KNOTS DIRECTION: 060 DEG DAY: 18 HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 143

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	25.9	58.0	16.1						1.1M	2.5M (15 18)

JUNE — DATA SUMMARY — 41004

AVERAGE LATITUDE 32.6N — AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.4	(13 18)	24.8	27.2	(29 00)	240	30
SEA TEMP (DEG C)	24.1	(17 12)	24.5	26.0	(27 18)	240	30
AIR-SEA TEMP (DEG C)	-04.8	(13 18)	-00.6	02.6	(09 03)	240	30
PRESSURE (MBAR)	1008.6	(09 00)	1016.3	1022.0	(06 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	MEAN SPEED (KNOTS)	TOTAL %
N	.4	3.7	2.5				6.7	10.3
NE		3.3	9.2				14.2	12.8
E	.8	4.6	6.3				11.7	10.4
SE	1.3	5.0	2.1				8.3	7.8
S	2.9	8.0	3.9				14.8	6.8
SW	2.1	6.7	22.5	.8			32.1	13.1
W	1.3	5.0	4.2				13.3	9.8
NW	.4	.4					2.1	9.2
CALM	1.7						1.7	.0
TOTAL	11.7	35.0	51.7	.8			100.0	10.7

NO. OF OBS: 240

MAX WIND SPEED: 23 KNOTS DIRECTION: 220 DEG DAY: 30 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	14.6	71.7	13.8						1.2M	2.5M (25 00)

MAY 41005

D A T A S U M M A R Y

AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.7	(26 00)	24.2	26.4	(22 18)	136	17
SEA TEMP (DEG C)	22.9	(18 06)	24.4	26.9	(21 21)	136	17
AIR-SEA TEMP (DEG C)	-02.9	(22 21)	-00.1	01.4	(22 18)	136	17
PRESSURE (MBAR)	1002.1	(26 00)	1015.8	1022.3	(31 18)	136	17

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	4.4	2.9					7.4	7.0
NE	.7	2.9	9.6	.7			14.0	13.6
E	1.5	4.4	6.6				12.5	11.3
SE		10.3	4.4	.7			15.4	9.4
S	1.5	11.8	9.6	.7			23.5	10.5
SW	.7	7.4	5.1				13.2	9.7
W	.7	4.4	4.4				9.6	9.6
NW	1.5	.7	1.5				3.7	7.8
CALM	.7						.7	.0
TOTAL	11.8	41.9	44.1	2.2			100.0	10.3

NO. OF OBS: 136

MAX WIND
SPEED: 25 KNOTS
DIRECTION: 200 DEG
DAY: 22
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 136

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	25.7	61.0	12.5	.7					1.1M	3.0M	(17 03)

JUNE 41005

D A T A S U M M A R Y

AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.2	(01 06)	25.6	27.8	(28 00)	239	30
SEA TEMP (DEG C)	24.3	(14 06)	26.2	28.5	(28 21)	239	30
AIR-SEA TEMP (DEG C)	-03.6	(21 18)	-00.6	01.5	(17 00)	239	30
PRESSURE (MBAR)	1010.1	(09 09)	1016.6	1022.1	(04 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	2.1	1.3				3.8	8.0
NE	.8	1.7	8.3	.4			11.3	13.7
E	.4	1.7	3.3				5.4	11.1
SE	.8	5.4	2.9				9.2	8.1
S		6.8	9.6				16.3	11.3
SW	1.3	10.4	21.3	.8			33.8	13.4
W	.4	6.3	5.8				12.1	9.9
NW	.4	1.7	1.7				3.8	9.0
CALM	2.5						2.5	.0
TOTAL	7.1	37.9	53.8	1.3			100.0	11.3

NO. OF OBS: 240

MAX WIND
SPEED: 23 KNOTS
DIRECTION: 040 DEG
DAY: 09
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	14.2	75.3	10.5						1.2M	2.5M	(16 09)

MAY 42001

D A T A S U M M A R Y

AVERAGE LATITUDE 25.9N AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	25.6	(01 21)	25.6	26.7	(27 00)	248	31
SEA TEMP (DEG C)	29.0	(02 12)	29.0	30.7	(26 21)	248	31
AIR-SEA TEMP (DEG C)	-03.7	(01 21)	-00.4	00.9	(18 15)	248	31
PRESSURE (MBAR)	1007.3	(26 00)	1012.9	1017.1	(04 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	3.2					4.8	5.5
NE	1.2	6.5	2.0				9.7	8.5
E	1.6	9.0	10.1	.4			16.1	10.8
SE	.4	6.9	29.6	3.2			39.1	14.1
S	1.6	12.9	10.9	.4			25.8	10.2
SW	.8	2.0	1.2				4.0	7.5
W	.4	.8	.4				1.6	6.8
NW	1.6		2.0				3.6	5.0
CALM	.8						.8	.0
TOTAL	10.1	36.3	49.6	4.0			100.0	11.0

NO. OF OBS: 248

MAX WIND
SPEED: 26 KNOTS
DIRECTION: 160 DEG
DAY: 17
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	43.6	52.0	4.0	.4					.9M	3.0M	(17 12)

JUNE 42001

D A T A S U M M A R Y

AVERAGE LATITUDE 25.9N AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	26.2	(01 06)	27.8	30.6	(26 00)	240	30
SEA TEMP (DEG C)	27.1	(06 12)	28.4	31.2	(25 21)	240	30
AIR-SEA TEMP (DEG C)	-02.6	(10 21)	-00.6	00.3	(24 15)	240	30
PRESSURE (MBAR)	1012.2	(10 09)	1016.6	1020.0	(30 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.1		.4				2.5	4.4
NE		1.7	.4				2.1	8.2
E	2.1	4.2	12.5				20.4	11.4
SE	1.7	12.9	17.9				32.5	10.2
S	.4	17.5	3.8				21.7	8.2
SW	2.1	7.1	.4				9.6	6.8
W	2.1	3.3	.4				5.8	5.7
NW	2.1	2.9					5.0	4.3
CALM								
TOTAL	12.5	51.7	35.8				100.0	9.0

NO. OF OBS: 240

MAX WIND
SPEED: 18 KNOTS
DIRECTION: 200 DEG
DAY: 20
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	68.7	31.3							.7M	1.5M	(15 18)

MAY 42002

D A T A S U M M A R Y

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.9	(09 00)	25.1	28.0	(27 00)	248	31
SEA TEMP (DEG C)	23.4	(02 12)	25.5	28.9	(26 21)	248	31
AIR-SEA TEMP (DEG C)	-04.0	(09 00)	-00.4	01.3	(16 18)	248	31
PRESSURE (MBAR)	1003.7	(16 09)	1011.4	1016.8	(05 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	2.0	.8	.4			3.6	9.9
NE	1.6	5.2	1.6				8.5	7.1
E	1.6	10.1	12.9				24.6	10.1
SE		14.5	33.1	2.8			50.4	13.9
S	.4	3.2	5.6				9.3	12.0
SW	.4		.4				.8	7.0
W	.8	.8					1.6	6.3
NW	.4		.4				.8	11.0
CALM	.4						.4	.0
TOTAL	6.0	35.9	54.8	3.2			100.0	11.8

NO. OF OBS: 248

MAX WIND
SPEED: 32 KNOTS
DIRECTION: 350 DEG
DAY: 09
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	39.5	51.2	9.3						1.0M	2.5M	(16 21)

JUNE 42002

D A T A S U M M A R Y

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.4	(10 18)	26.0	30.3	(21 21)	240	30
SEA TEMP (DEG C)	27.4	(12 12)	28.6	31.0	(26 21)	240	30
AIR-SEA TEMP (DEG C)	-03.9	(10 18)	-00.7	00.2	(07 00)	240	30
PRESSURE (MBAR)	1012.0	(10 09)	1015.5	1019.6	(04 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.7	.8					2.5	3.7
NE		.4	.8				1.3	9.3
E	1.3	4.2	15.4				22.9	11.6
SE		12.1	28.3				40.4	11.8
S	.8	11.4	15.0				28.8	10.6
SW	1.7	2.1	1.3				5.0	6.1
W		1.3					1.3	6.0
NW		.4					.8	6.0
CALM								
TOTAL	5.0	34.2	60.8				100.0	10.8

NO. OF OBS: 240

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 130 DEG
DAY: 16
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	36.7	61.3							.8M	1.5M	(16 09)

MAY 42003

D A T A S U M M A R Y

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.0	(02 12)	26.0	29.7	(24 21)	248	31
SEA TEMP (DEG C)	24.1	(03 12)	27.6	29.0	(26 00)	248	31
AIR-SEA TEMP (DEG C)	-04.5	(22 09)	-01.6	00.1	(08 18)	248	31
PRESSURE (MBAR)	1008.2	(26 00)	1014.5	1018.7	(18 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	6.0	3.6				10.1	9.0
NE		3.2	2.0				5.2	10.3
E		4.0	22.2				26.2	13.0
SE	.4	6.0	15.1	.4			25.0	12.2
S	1.6	7.7	6.9				16.1	9.5
SW	.8	2.8	2.4				6.0	9.4
W		2.4	6.4				8.9	9.5
NW		4.0	2.8				6.9	11.5
CALM								
TOTAL	3.2	36.3	60.1	.4			100.0	11.2

NO. OF OBS: 248

MAX WIND
SPEED: 23 KNOTS
DIRECTION: 150 DEG
DAY: 17
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	41.5	55.2	3.2						.9M	2.5M	(17 18)

JUNE 42003

D A T A S U M M A R Y

AVERAGE LATITUDE 24.6N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.8	(11 15)	27.7	29.7	(30 00)	240	30
SEA TEMP (DEG C)	27.9	(05 09)	28.8	30.5	(09 21)	240	30
AIR-SEA TEMP (DEG C)	-04.7	(11 15)	-01.1	00.6	(28 15)	240	30
PRESSURE (MBAR)	1012.8	(10 09)	1017.7	1020.9	(17 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	3.8	1.3	.4				5.4	3.9
NE	1.3	4.2	3.3				8.8	8.2
E	1.3	17.1	16.7				35.0	10.1
SE	2.9	6.7	1.7				11.3	6.1
S	2.5	7.5	.4				10.4	5.8
SW	2.5	7.5	1.3				11.3	6.1
W	3.3	8.7	7.1				17.1	6.3
NW	.8	2.5	.8				4.2	8.5
CALM	1.7						1.7	.0
TOTAL	20.0	53.5	26.7				100.0	7.5

NO. OF OBS: 240

MAX WIND
SPEED: 20 KNOTS
DIRECTION: 330 DEG
DAY: 27
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	59.2	38.3	2.5						.6M	2.0M	(14 18)

MAY — 04002

DATA SUMMARY

AVERAGE LATITUDE 40.1N — AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.1	(03 06)	12.3	17.3	(24 21)	247	31
SEA TEMP (DEG C)	07.0	(02 12)	10.9	15.4	(31 21)	247	31
AIR-SEA TEMP (DEG C)	-01.1	(08 09)	01.3	04.8	(06 00)	247	31
PRESSURE (MBAR)	0999.9	(25 09)	1012.4	1030.5	(17 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	8.9	.8				10.5	7.4
NE	.8	3.2	2.6				6.9	9.4
E	.8	6.1	7.3				14.2	10.4
SE	1.2	2.8	.8				4.9	5.7
S	.4	4.9	2.0				7.3	8.5
SW	1.2	14.2	6.1				21.5	8.2
W	2.0	16.6	4.0				20.7	7.7
NW	1.6	6.9	1.2				9.7	6.8
CALM	.4						.4	.0
TOTAL	9.3	65.6	25.1				100.0	8.1

NO. OF OBS: 247

MAX WIND
SPEED: 20 KNOTS
DIRECTION: 040 DEG
DAY: 21
HOUR: 18

JUNE — 04002

DATA SUMMARY

AVERAGE LATITUDE 40.1N — AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.7	(09 09)	18.7	21.7	(30 21)	240	30
SEA TEMP (DEG C)	17.0	(10 09)	19.9	22.7	(29 21)	240	30
AIR-SEA TEMP (DEG C)	-03.8	(09 09)	01.9	03.9	(01 06)	240	30
PRESSURE (MBAR)	1008.7	(03 16)	1019.1	1026.4	(12 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	2.5	2.1	1.3			7.1	11.9
NE	2.1	5.1	.4				8.3	6.1
E	1.3	2.9					4.2	6.9
SE	.8	3.3	.4				4.6	5.4
S	2.1	6.8	1.3				12.1	6.6
SW	2.9	20.0	5.8	.8			29.6	9.8
W	.8	15.8	4.6				21.3	8.4
NW	1.7	5.8	3.8	.8			11.7	9.7
CALM	2.1						2.1	.8
TOTAL	15.0	66.2	18.3	2.5			100.0	8.1

NO. OF OBS: 240

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 350 DEG
DAY: 09
HOUR: 03

MAY — 04003

DATA SUMMARY

AVERAGE LATITUDE 40.0N — AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.0	(02 21)	08.6	13.6	(31 18)	248	31
SEA TEMP (DEG C)	05.9	(04 12)	07.1	10.1	(29 21)	248	31
AIR-SEA TEMP (DEG C)	-00.9	(02 21)	01.5	05.2	(31 18)	248	31
PRESSURE (MBAR)	0999.1	(25 18)	1012.4	1031.4	(18 03)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	5.6	3.6				10.1	8.7
NE	.4	2.0	1.6	1.6			5.6	10.8
E	1.2	8.9	2.8				12.9	7.0
SE	1.2	3.2	.4				4.8	5.2
S	1.2	9.3	4.0				14.5	8.4
SW	1.6	7.7	3.6				12.9	7.8
W	2.4	8.5	4.0				14.9	7.9
NW	.8	10.1	1.6				12.5	7.4
CALM	1.2						1.2	.0
TOTAL	13.7	61.3	23.8	1.6			100.0	7.8

NO. OF OBS: 248

MAX WIND
SPEED: 26 KNOTS
DIRECTION: 040 DEG
DAY: 02
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	30.6	58.9	6.5	4.0					1.2M	3.5M (03 12)

JUNE — 04003

DATA SUMMARY

AVERAGE LATITUDE 40.0N — AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.6	(13 06)	10.9	14.6	(22 21)	177	23
SEA TEMP (DEG C)	08.1	(09 00)	09.0	11.0	(22 21)	177	23
AIR-SEA TEMP (DEG C)	-00.3	(13 04)	01.9	05.1	(09 03)	177	23
PRESSURE (MBAR)	0996.7	(09 03)	1014.3	1029.5	(13 15)	177	23

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.3	5.1	.6				7.9	5.7
NE		5.1	1.7				6.8	8.2
E		3.4	1.1				4.5	7.6
SE	1.7	3.4	2.3				7.4	6.9
S	4.0	13.6	9.6				27.1	8.9
SW	2.8	7.3	7.9				18.1	9.2
W	2.3	6.2	5.6				14.1	8.5
NW	3.4	7.9	1.7				13.0	5.8
CALM	1.1						1.1	.0
TOTAL	17.5	52.0	30.5				100.0	7.9

NO. OF OBS: 177

MAX WIND
SPEED: 20 KNOTS
DIRECTION: 150 DEG
DAY: 01
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 177

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	34.1	43.3	16.9	5.6					1.4M	3.5M (09 15)

MAY — 04004

DATA SUMMARY

AVERAGE LATITUDE 39.0N — AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.0	(03 06)	11.8	15.8	(31 21)	248	31
SEA TEMP (DEG C)	13.7	(04 15)	14.6	19.1	(31 21)	248	31
AIR-SEA TEMP (DEG C)	-07.0	(03 06)	-00.7	03.2	(08 21)	248	31
PRESSURE (MBAR)	1008.4	(28 18)	1018.1	1032.2	(18 03)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.0	6.9	.8			9.7	10.4
NE			.8	3.6	1.2		5.6	16.9
E		1.2	7.3	3.6			12.9	14.3
SE	.4	1.2	4.4				6.8	13.5
S	1.2	5.2	7.7	.8			14.9	12.7
SW	.4	5.2	15.3	1.6			22.6	13.3
W	.4	6.5	12.1				19.0	12.7
NW	.4	3.6	10.1				14.1	12.9
CALM	.4						.4	.0
TOTAL	3.2	25.0	67.3	6.4			100.0	13.4

NO. OF OBS: 248

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 040 DEG
DAY: 02
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	24.6	63.3	8.5	3.6					1.2M	3.5M (03 06)

JUNE — 04004

DATA SUMMARY

AVERAGE LATITUDE 39.0N — AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	13.2	(09 15)	16.0	19.0	(16 18)	163	21
SEA TEMP (DEG C)	17.4	(10 12)	19.2	21.6	(16 21)	163	21
AIR-SEA TEMP (DEG C)	-05.5	(09 15)	-03.2	02.9	(03 03)	163	21
PRESSURE (MBAR)	1001.3	(15 03)	1016.8	1027.7	(13 03)	163	21

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.6	3.1	8.0				11.7	13.1
NE		3.1	9.2	1.2			13.5	13.2
E		3.7	7.4				11.0	11.6
SE		.6	3.8				4.5	13.8
S	.6	1.9	9.2	2.5			14.1	17.3
SW	.6	3.7	10.6	1.8			20.2	16.6
W		3.1	9.8	1.8	.6		15.3	16.2
NW	.6	3.1	6.7	1.2			11.7	13.6
CALM								
TOTAL	2.5	19.6	68.7	8.6	.6		100.0	14.0

NO. OF OBS: 163

MAX WIND
SPEED: 41 KNOTS
DIRECTION: 290 DEG
DAY: 15
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 163

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	12.3	57.7	22.1	7.4	.6				1.5M	4.0M (15 06)

MAY — 04001

DATA SUMMARY

AVERAGE LATITUDE 40.0N — AVERAGE LONGITUDE 067.6W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.2	(08 12)	04.6	09.3	(25 03)	248	31
SEA TEMP (DEG C)	00.7	(02 09)	01.5	02.3	(31 21)	248	31
AIR-SEA TEMP (DEG C)	00.0	(08 12)	03.0	07.4	(25 03)	248	31
PRESSURE (MBAR)	0993.0	(11 06)	1013.9	1028.2	(16 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		5.2	5.2				10.5	10.5
NE	2.0	6.9	6.9				15.7	7.2
E	2.0	9.7	4.0				15.7	7.0
SE	.8	4.4	2.4				7.7	8.3
S	.8	4.4	2.4				7.7	8.8
SW	.8	8.5	5.2				14.5	9.2
W	1.6	10.5	3.6				15.8	7.7
NW	.4	7.7	5.6				13.7	10.1
CALM	.4						.4	.0
TOTAL	8.9	61.7	29.4				100.0	8.3

NO. OF OBS: 248

MAX WIND
SPEED: 18 KNOTS
DIRECTION: 350 DEG
DAY: 31
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	62.9	36.7	.4						.6M	2.0M (11 12)

JUNE — 04001

DATA SUMMARY

AVERAGE LATITUDE 40.0N — AVERAGE LONGITUDE 067.6W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.6	(16 12)	10.9	14.2	(26 03)	240	30
SEA TEMP (DEG C)	01.9	(04 09)	02.4	03.1	(30 18)	240	30
AIR-SEA TEMP (DEG C)	05.7	(04 12)	08.5	11.0	(16 03)	240	30
PRESSURE (MBAR)	1002.1	(29 12)	1014.9	1027.7	(04 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	5.4	4.6				14.2	9.1
NE	.8	5.1	1.7				7.9	7.9
E	2.1	6.3	.8				9.2	6.1
SE	.8	7.5	5.8				14.2	9.6
S	.8	7.9	5.0				13.8	8.6
SW	.8	9.6	3.3				13.8	9.0
W	2.1	12.1	3.8				17.9	7.2
NW	1.3	7.5	.8				9.6	6.0
CALM								
TOTAL	9.8	64.6	25.8				100.0	8.1

NO. OF OBS: 240

MAX WIND
SPEED: 19 KNOTS
DIRECTION: 130 DEG
DAY: 28
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	74.1	25.1	.8						.4M	2.0M (29 18)

MAY — DATA SUMMARY — 45002

AVERAGE LATITUDE 45.3N — AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.6	(09 06)	05.6	12.7	(25 00)	202	26
SEA TEMP (DEG C)	02.3	(09 06)	02.8	03.3	(31 21)	202	26
AIR-SEA TEMP (DEG C)	00.3	(09 06)	02.7	09.5	(25 00)	202	26
PRESSURE (MBAR)	0996.3	(11 06)	1016.2	1030.6	(16 15)	202	26

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.0	8.4	1.8				11.9	6.9
NE	1.5	5.0	3.5				9.9	8.7
E	2.5	12.9	1.8				16.3	5.9
SE	1.5	5.4	.5				7.4	5.5
S	2.5	11.9	3.5				17.8	7.2
SW	.5	12.9	4.0				17.3	8.3
W	2.5	5.9	1.5				9.9	6.4
NW	.5	5.4	3.0				8.9	9.7
CALM	.5						.5	.0
TOTAL	15.9	67.0	18.3				100.0	7.3

NO. OF OBS: 202

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 210 DEG
DAY: 11
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 193

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	83.9	15.0	1.0						.4M	2.5M	(11 06)

JUNE — DATA SUMMARY — 45002

AVERAGE LATITUDE 45.3N — AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.0	(10 09)	07.2	18.3	(24 21)	240	30
SEA TEMP (DEG C)	03.1	(01 23)	04.5	10.1	(25 00)	240	30
AIR-SEA TEMP (DEG C)	00.3	(10 09)	02.7	09.1	(24 21)	240	30
PRESSURE (MBAR)	0998.8	(24 12)	1015.4	1029.8	(04 18)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	11.7	7.9				20.8	10.0
NE	.8	2.9	2.1				5.8	8.3
E	1.7	7.1	1.3				10.0	7.4
SE	.8	3.3	1.3				5.4	7.2
S	1.3	10.4	2.9				15.0	8.4
SW	.4	14.2	11.7				26.3	9.9
W	.4	7.5					8.1	6.7
NW	.8	6.3	.4				7.5	6.6
CALM	.8						.8	.0
TOTAL	8.3	64.1	27.5				100.0	8.6

NO. OF OBS: 240

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 230 DEG
DAY: 08
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	87.9	10.3	1.3						.5M	2.0M	(18 03)

MAY — DATA SUMMARY — 45003

AVERAGE LATITUDE 45.3N — AVERAGE LONGITUDE 082.8W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.7	(26 18)	07.2	12.6	(23 03)	85	11
SEA TEMP (DEG C)	02.7	(24 09)	02.9	03.2	(30 21)	84	11
AIR-SEA TEMP (DEG C)	01.6	(26 18)	04.4	10.1	(23 03)	84	11
PRESSURE (MBAR)	1002.3	(31 09)	1015.2	1023.3	(26 15)	85	11

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.4	7.1					9.4	6.0
NE		5.9	2.4				8.2	9.7
E	2.4	16.5	1.2				20.0	7.2
SE	2.4	5.9	3.5				11.8	7.7
S	1.2	12.9	5.9				20.0	8.3
SW		7.1	1.2				8.2	8.7
W		9.4		1.2			10.6	8.6
NW	1.2	7.1	1.2				9.4	7.6
CALM	2.4						2.4	.0
TOTAL	11.8	71.8	15.3	1.2			100.0	7.5

NO. OF OBS: 85

MAX WIND
SPEED: 25 KNOTS
DIRECTION: 280 DEG
DAY: 31
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 85

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	91.8	8.2							.2M	1.5M	(31 21)

JUNE — DATA SUMMARY — 45003

AVERAGE LATITUDE 46.3N — AVERAGE LONGITUDE 082.8W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.5	(10 09)	07.2	13.1	(24 00)	240	30
SEA TEMP (DEG C)	02.6	(02 12)	03.6	06.0	(26 21)	240	30
AIR-SEA TEMP (DEG C)	00.3	(10 09)	03.3	06.8	(26 06)	240	30
PRESSURE (MBAR)	1002.4	(08 00)	1014.4	1025.7	(04 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	5.8	2.5				9.0	8.7
NE	.8	2.9	.8				4.6	6.5
E	1.3	6.7	1.3				10.8	6.6
SE	.8	5.0	.8				7.5	6.7
S	1.7	15.7	5.4				22.1	8.5
SW	1.3	7.5					8.9	5.7
W	.8	15.0	8.8	.8			20.4	10.4
NW	1.7	7.5	7.5				16.7	10.1
CALM	.8						.8	.0
TOTAL	9.2	62.9	27.1	.8			100.0	8.6

NO. OF OBS: 240

MAX WIND
SPEED: 26 KNOTS
DIRECTION: 290 DEG
DAY: 08
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	72.5	25.8	1.7						.5M	2.0M	(02 21)

MAY — DATA SUMMARY — 45004

AVERAGE LATITUDE 47.2N — AVERAGE LONGITUDE 086.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.9	(07 18)	05.4	13.7	(23 00)	179	25
SEA TEMP (DEG C)	01.3	(02 06)	02.2	02.7	(31 21)	179	25
AIR-SEA TEMP (DEG C)	-00.3	(07 18)	03.2	11.3	(23 00)	179	25
PRESSURE (MBAR)	0998.4	(31 06)	1014.2	1027.2	(16 21)	179	25

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.7	6.7	1.7				10.1	7.2
NE	1.1	2.8	1.7				5.6	8.4
E	1.1	10.6	9.5				21.0	8.6
SE	.6	11.7	1.7				14.0	7.6
S	.6	5.6					6.1	6.5
SW	1.1	10.6					11.7	6.9
W	.6	8.7	1.7				8.9	6.9
NW	1.1	9.5	8.9				19.0	9.7
CALM	.6						.6	.0
TOTAL	8.4	72.1	19.6				100.0	7.9

NO. OF OBS: 179

MAX WIND
SPEED: 19 KNOTS
DIRECTION: 330 DEG
DAY: 31
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 173

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	83.8	14.5	1.7						.5M	2.5M	(31 15)

JUNE — DATA SUMMARY — 45004

AVERAGE LATITUDE 47.2N — AVERAGE LONGITUDE 086.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.0	(08 15)	06.7	11.5	(25 21)	240	30
SEA TEMP (DEG C)	02.5	(01 09)	03.7	05.7	(30 18)	240	30
AIR-SEA TEMP (DEG C)	00.2	(08 15)	02.9	08.1	(25 21)	240	30
PRESSURE (MBAR)	1001.7	(29 12)	1014.7	1027.6	(04 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	7.5	3.3				12.1	8.3
NE	.4	5.0					5.4	6.3
E	1.7	6.7	2.9				11.3	7.7
SE	1.3	7.9	1.7				11.7	7.8
S	1.7	17.4	4.6				14.7	8.0
SW	.8	6.7	3.3				10.8	8.6
W	1.3	7.9	.8				10.4	6.8
NW	1.3	12.1	6.7				20.9	8.8
CALM	1.7						1.7	.0
TOTAL	11.3	65.4	23.3				100.0	7.8

NO. OF OBS: 240

MAX WIND
SPEED: 20 KNOTS
DIRECTION: 340 DEG
DAY: 08
HOUR: 08

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	76.7	21.7	1.3	.4					.5M	3.0M	(08 03)

MAY — DATA SUMMARY — 46001

AVERAGE LATITUDE 56.0N — AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.5	(08 09)	05.3	07.8	(22 03)	248	31
SEA TEMP (DEG C)	04.9	(22 12)	05.8	07.4	(22 03)	248	31
AIR-SEA TEMP (DEG C)	-01.8	(20 03)	-00.5	00.9	(05 18)	248	31
PRESSURE (MBAR)	0986.4	(19 15)	1009.7	1026.1	(04 09)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.8	2.0				2.8	12.2
NE		2.8	3.6				6.5	10.9
E		2.8	7.7	6.5			16.9	14.3
SE		2.4	10.5	6.9			19.8	13.8
S		6.9	19.7	2.4			29.0	14.1
SW		5.2	11.3	4.0			20.6	14.9
W	.4	1.6	3.2	2.0			7.3	14.6
NW		1.2					1.2	9.7
CALM								
TOTAL	.8	23.8	54.8	21.8			100.0	15.6

NO. OF WAVE OBS: 247

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		19.0	46.6	25.9	8.5				2.5M	5.5M	(10 21)

JUNE — DATA SUMMARY — 46001

AVERAGE LATITUDE 56.0N — AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.4	(12 18)	07.8	10.3	(24 00)	239	30
SEA TEMP (DEG C)	06.1	(02 15)	08.4	11.2	(24 03)	239	30
AIR-SEA TEMP (DEG C)	-01.8	(26 09)	-00.6	00.5	(27 06)	239	30
PRESSURE (MBAR)	0993.9	(23 00)	1019.3	1028.6	(04 00)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	1.7	.8				3.8	6.8
NE		1.3					1.3	7.3
E	.4	2.5					2.9	5.6
SE	.4	3.8	.8				4.7	8.8
S	.4	6.3	7.5	2.5			16.7	13.8
SW		14.6	12.1	.4			27.2	11.2
W	.4	6.3	32.2	2.1			41.0	14.7
NW		.4	2.5				2.9	11.0
CALM								
TOTAL	2.9	36.0	56.1	5.0			100.0	12.6

NO. OF WAVE OBS: 239

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	13.8	67.8	12.2	1.3					1.0M	3.0M	(13 15)

MAY — DATA SUMMARY — 46002

AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.0	(09 15)	10.5	12.7	(20 06)	248	31
SEA TEMP (DEG C)	11.9	(09 15)	12.8	13.3	(21 00)	248	31
AIR-SEA TEMP (DEG C)	-03.9	(09 15)	-01.9	-00.2	(05 09)	248	31
PRESSURE (MBAR)	1006.9	(09 09)	1021.1	1030.2	(02 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 248
N		3.6	22.6	3.6			29.8	16.5	MAX WIND
NE		.4	1.2				1.6	12.3	SPEED: 27 KNOTS
E		.8					.8	5.5	DIRECTION: 290 DEG
SE		.8	.4				1.2	12.3	DAY: 09
S		1.2	5.6	.4			7.3	14.5	HOUR: 06
SW		3.6	6.9	.4			10.9	12.4	
W	.4	9.7	9.3	.8			20.2	11.9	
NW		6.0	17.7	6.4			29.2	15.2	
CALM									
TOTAL	.4	26.2	63.7	9.7			100.0	14.9	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		14.9	40.1	18.1	8.9				2.4M	8.0M (23 06)

JUNE — DATA SUMMARY — 46002

AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.4	(16 15)	12.0	14.9	(18 21)	240	30
SEA TEMP (DEG C)	12.3	(01 15)	13.7	17.6	(19 00)	240	30
AIR-SEA TEMP (DEG C)	-03.0	(24 10)	-01.7	-00.2	(25 03)	240	30
PRESSURE (MBAR)	1008.6	(24 10)	1023.5	1038.9	(27 06)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<9	11	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 240
N		1.7	21	3.3			32.9	14.0	MAX WIND
NE		.4	5.0	25.4	1.3		32.9	7.3	SPEED: 25 KNOTS
E		.4		.4			1.3		DIRECTION: 280 DEG
SE		.4					1.3	8.3	DAY: 29
S		.8	2.9	.8			4.6	6.9	HOUR: 21
SW		.8	5.4	7.3			9.6	9.4	
W		.4	10.8	13.3	.4		25.0	10.8	
NW		.8	8.8	18.3			25.4	12.8	
CALM									
TOTAL		5.0	34.2	60.4	1.7		100.0	12.0	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	5.0	72.9	16.8	2.9	.4				1.4M	4.0M (25 00)

MAY — DATA SUMMARY — 46004

AVERAGE LATITUDE 51.6N — AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.8	(02 09)	07.2	09.1	(30 12)	248	31
SEA TEMP (DEG C)	06.3	(02 15)	07.4	09.6	(13 00)	248	31
AIR-SEA TEMP (DEG C)	-02.0	(19 15)	-00.2	01.3	(04 18)	248	31
PRESSURE (MBAR)	0996.8	(08 18)	1017.5	1038.8	(23 21)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 248
N	.4	3.2	4.0	1.6			9.3	12.8	MAX WIND
NE			1.2				1.2	19.7	SPEED: 35 KNOTS
E		.8	3.2				4.0	15.5	DIRECTION: 170 DEG
SE		.4	1.2	1.2			2.8	17.4	DAY: 18
S		2.4	11.7	5.6	.4		20.2	18.2	HOUR: 21
SW	.4	3.6	11.3	2.8			17.3	14.7	
W	.8	4.4	7.7	.4			13.3	11.6	
NW	1.6	7.7	16.5	4.8			29.6	13.9	
CALM									
TOTAL	3.2	23.8	58.5	14.9	.4		100.0	14.9	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		27.5	54.1	18.3					2.1M	3.5M (19 09)

JUNE — DATA SUMMARY — 46004

AVERAGE LATITUDE 51.6N — AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.5	(07 15)	09.1	11.9	(25 03)	240	30
SEA TEMP (DEG C)	10.7	(26 00)	10.7	12.0	(26 00)	240	30
AIR-SEA TEMP (DEG C)	-01.6	(07 15)	-01.1	01.6	(05 15)	240	30
PRESSURE (MBAR)	1013.7	(23 15)	1022.9	1029.8	(29 03)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<9	11	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 240
N		1.2	2.1	2.9			21.3	15.3	MAX WIND
NE		1.7	2.1				3.8	11.6	SPEED: 27 KNOTS
E		1.7	1.3				2.5	10.5	DIRECTION: 350 DEG
SE		.4	2.1				2.9	11.3	DAY: 04
S		3.3	14.2				17.5	13.6	HOUR: 03
SW		2.1	6.3				8.3	12.2	
W	.8	.4	9.3	1.3			11.8	10.8	
NW	.4	1.3	23.8	7.5			32.9	14.8	
CALM									
TOTAL	.8	15.1	72.5	11.7			100.0	14.9	

MAY — DATA SUMMARY — 46005

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.3	(11 18)	09.0	10.6	(19 09)	248	31
SEA TEMP (DEG C)	08.9	(02 15)	09.8	10.5	(18 21)	248	31
AIR-SEA TEMP (DEG C)	-02.0	(11 18)	-00.8	00.6	(19 18)	248	31
PRESSURE (MBAR)	1001.3	(09 03)	1018.9	1031.6	(03 00)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 248
N		2.0	12.9	1.2			16.5	13.4	MAX WIND
NE			1.2				1.2	11.3	SPEED: 30 KNOTS
E		.8	2.4				3.2	13.6	DIRECTION: 330 DEG
SE		2.0	5.6	.8			8.5	14.4	DAY: 23
S		3.6	7.3	2.0			12.9	14.0	HOUR: 02
SW	.4	1.2	8.5				10.1	13.0	
W		2.8	16.7	1.6			20.2	13.6	
NW	.4		16.5	10.1			27.0	20.0	
CALM									
TOTAL	.8	12.0	70.6	15.7			100.0	16.0	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		25.0	55.0	15.7	2.5				2.3M	4.5M (23 06)

JUNE — DATA SUMMARY — 46005

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.0	(06 12)	10.7	12.8	(22 15)	240	30
SEA TEMP (DEG C)	09.6	(13 15)	11.3	12.9	(21 00)	240	30
AIR-SEA TEMP (DEG C)	-02.6	(24 17)	-00.6	00.6	(07 18)	240	30
PRESSURE (MBAR)	1004.6	(24 17)	1019.5	1034.6	(27 21)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 240
N		3.5	11.3	.8			16.4	11.0	MAX WIND
NE		2.5	9.6				5.0	12.6	SPEED: 24 KNOTS
E		1.3					1.3	7.7	DIRECTION: 320 DEG
SE		2.1	3.3				5.4	11.7	DAY: 02
S	.8	0.2	2.1				12.1	8.1	HOUR: 09
SW		6.7	1.3				7.9	6.9	
W		3.3	9.6				17.1	12.5	
NW	.8	11.7	24.6	2.9			40.0	13.2	
CALM	.4						.4	.0	
TOTAL	2.1	30.1	56.1	3.8			100.0	11.0	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 72

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		41.1	44.4						1.9M	2.5M (03 03)

MAY — DATA SUMMARY — 46010

AVERAGE LATITUDE 48.2N — AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.5	(23 09)	10.8	12.6	(29 00)	248	31
SEA TEMP (DEG C)	10.3	(04 06)	12.2	14.5	(29 03)	248	31
AIR-SEA TEMP (DEG C)	-04.0	(23 09)	-01.4	01.7	(04 06)	248	31
PRESSURE (MBAR)	1000.8	(09 18)	1016.9	1026.2	(02 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 248
N	.4	8.9	10.5				19.8	11.2	MAX WIND
NE	.4	1.2					1.6	5.0	SPEED: 28 KNOTS
E	.8	.8					1.6	4.3	DIRECTION: 360 DEG
SE	.4	6.9	.4				7.8	10.2	DAY: 06
S	1.2	4.4	6.9				12.5	10.9	HOUR: 06
SW	2.0	4.8	2.8				9.7	8.4	
W	3.2	10.1	4.8				24.2	7.5	
NW	1.2	15.3	8.1				24.6	9.1	
CALM	2.8						2.8	.0	
TOTAL	12.1	54.9	33.5				100.0	8.9	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 237

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		31.6	41.8	6.8					2.0M	3.5M (24 09)

JUNE — DATA SUMMARY — 46010

AVERAGE LATITUDE 48.2N — AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.4	(03 12)	12.5	14.4	(28 03)	162	25
SEA TEMP (DEG C)	08.9	(12 15)	13.2	16.5	(29 21)	194	26
AIR-SEA TEMP (DEG C)	-03.2	(03 15)	-00.8	01.7	(21 03)	162	25
PRESSURE (MBAR)	1009.3	(29 15)	1019.6	1028.5	(27 21)	194	26

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 178
N	.6	7.9	20.2				28.7	13.3	MAX WIND
NE									SPEED: 19 KNOTS
E		1.7					1.7	6.8	DIRECTION: 360 DEG
SE		1.1	1.7				2.8	10.2	DAY: 18
S	.6	1.7	11.8				14.4	11.9	HOUR: 06
SW	.6	0.0	2.8				11.8	6.7	
W	1.7	9.0	7.9				19.7	8.3	
NW	1.1	5.4	19.0				23.6	11.3	
CALM	2.8						2.8	.0	
TOTAL	7.3	26.7	57.9				100.0	10.8	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 192

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	19.8	69.8	10.1	3.6					1.3M	3.5M (02 09)

Continued on page 453.

Selected Gale and Wave Observations, North Atlantic

May and June 1980

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH ATLANTIC OCEAN		MAY															
PROSPERITY QUEEN	S6EP	2	36.6 N	18.9 W	18	33	M 35	10 NM	18	1009.1	22.0	18.0	4	5	32	7	10
AMERICAN ACCORD	KFEZ	2	46.6 N	39.2 W	18	32	42	10 NM	01	0999.8	8.9	13.9	9	18	31	9	16.5
AMERICAN LEGACY	KFGJ	3	43.6 N	63.8 W	00	07	40	1 NM	41	1010.0	2.2	4.4	3	8	07	6	14.5
PROSPERITY QUEEN	S6EP	3	36.4 N	16.9 W	00	33	M 35	10 NM	03	1010.0	16.1	17.0	3	5	33	6	10
ULTRASEA	WJCG	3	47.3 N	29.8 W	12	22	25	10 NM	50	1001.4	11.1	10.0	8	26	25	12	24.5
AMERICAN ACE	KFCV	3	50.2 N	29.0 W	12	18	35	2 NM	16	0992.6	12.8	11.7	3	11.5	23	6	13
T F L INDEPENDENCE	9VVK	3	50.1 N	25.5 W	12	12	M 37	.5 NM	10	0998.5	12.0	11.5	8	18	14	12	13
SEALAND CONSUMER	WCHF	3	45.2 N	32.2 W	18	27	40	10 NM	02	1001.5	13.3	12.8	9	11.5	27	>13	21
SEALAND CONSUMER	WCHF	4	44.3 N	34.8 W	00	27	35	10 NM	02	1002.5	12.3	13.3	7	10	27	>13	21
ULTRASEA	WJCG	4	49.0 N	18.5 W	18	13	35	2 NM	61	1001.7	12.2	9.5	13	8	13	< 6	10
ULTRASEA	WJCG	5	49.5 N	13.6 W	06	11	35	2 NM	02	1005.1	12.2	9.5	3	10	11	6	14.5
SEALAND CONSUMER	WCHF	5	41.2 N	48.0 W	06	25	36	5 NM	02	0996.0	15.6	15.6	8	8			
SEALAND CONSUMER	WCHF	5	39.9 N	53.0 W	16	24	36	5 NM	62	0994.2	15.6	15.6	6	8	24	9	8
COVADONGA	EHDV	5	36.1 N	59.6 W	18	27	35	10 NM	81	1007.0	17.0	21.0	8	13			
SEALAND CONSUMER	WCHF	6	39.3 N	54.8 W	00	32	40	5 NM	02	0999.8	14.0	14.4	6	14.5	30	9	16.5
SEALAND CONSUMER	WCHF	6	38.6 N	57.0 W	06	28	35	10 NM	02	1000.1	13.9	16.7	6	14.5	30	9	16.5
SEALAND RESOURCE	WJKD	6	41.3 N	51.4 W	18	28	35	5 NM	03	0999.0	13.5	15.0	6	8	25	7	10
AMERICAN LEGEND	KFEY	6	46.9 N	11.8 W	18	08	40	5 NM	62	1001.7	10.0	11.7	6	13	08	10	16.5
TFL EXPRESS	9VPU	7	45.9 N	29.1 W	18	13	M 37	5 NM	50	1004.5	14.0	14.0	5	5	13	< 6	5
TFL EXPRESS	9VPU	8	46.3 N	26.7 W	00	14	M 38	5 NM	60	1005.5	13.5	14.0					
TFL EXPRESS	9VPU	9	48.0 N	17.0 W	00	14	M 45	5 NM	50	1008.5	13.0	13.5					
AMERICAN LEADER	KFEJ	9	50.8 N	16.6 W	06	18	35	2 NM	81	1004.1	10.0						
SEALAND RESOURCE	WJKD	9	47.9 N	19.2 W	06	18	50	1 NM	82	1000.5	14.0	11.1	5	11.5	00		0
GULF SHIPPER	KEMP	9	40.8 N	34.3 W	12	30	35	10 NM	01	1016.5	16.7	14.4	5	13	28	7	16.5
AMERICAN ALLIANCE	KFEM	10	49.7 N	34.6 W	06	34	35	10 NM	02	1010.0	6.7	12.2	6	13	34	< 6	10
TFL DEMOCRACY	9VPR	10	50.2 N	18.3 W	06	17	M 22	5 NM	58	0999.5	14.5	12.0	9	28	20	8	24.5
MARITIME HARMONY	5MFC	10	50.1 N	11.3 W	18	16	M 40	200 YD	11	1011.3	12.0	9.0	8	23	16	8	23
AMERICAN LEADER	KFEJ	10	50.0 N	33.3 W	18	32	36	10 NM	01	1009.9	7.8		4	10	32	8	16.5
YUKON T-AO 152	NUOP	11	56.6 N	39.2 W	06	34	30	5 NM	20	1002.4	3.3	8.8	4	10	34	12	29.5
TFL DEMOCRACY	9VPR	12	47.5 N	40.0 W	12	27	M 26	5 NM	02	1009.0	10.5	13.0	6	13	26	10	26
NORMACGLEN	WNDL	12	09.6 N	45.3 W	17	09	35	10 NM	02	1011.5	27.6	27.6	4	5	09	< 6	10
HOWARD G VESPER	6ZOU	15	35.2 N	74.7 W	06	02	M 40	5 NM	01	1013.0	19.0	24.0					
CRISTOBAL	WCOQ	17	25.9 N	87.7 W	18	18	35	10 NM	02	1015.9	28.9	23.3	5	5	18	< 6	5
ALGENIB	9VDR	18	40.0 N	46.7 W	12	36	M 36	5 NM	80	1017.7	12.0	17.4	8	10	36	>13	
HOWARD G VESPER	6ZOU	21	34.7 N	74.7 W	06	19	M 35	5 NM	25	1009.5	24.5	26.0	4	16.5			
DELAWARE GETTY	KCBE	21	28.2 N	78.2 W	12	20	35	10 NM	13	1015.8	25.0	26.7	5	6.5	20	< 6	6.5
TFL EXPRESS	9VPU	21	46.9 N	43.0 W	18	32	M 45	10 NM	03	1006.5	7.5	6.5	4	8	32	>13	10
TFL EXPRESS	9VPU	22	46.5 N	45.4 W	00	31	M 37	10 NM	01	1016.0	5.0	7.0					
SEALAND RESOURCE	WJKD	22	42.1 N	49.9 W	00	31	35	5 NM	02	1017.0	10.0	13.4	5	10	24	8	11.5
DAWN	WLDP	22	37.0 N	69.5 W	00	25	35	10 NM	07	1010.0	23.3	23.8	3	6.5	26	7	16.5
TFL DEMOCRACY	9VPR	22	39.5 N	62.6 W	11	25	M 25	5 NM	02	1007.5	21.5	20.0	7	28	24	9	24.5
BUNGA CHEMPAKA	9MTR	22	42.9 N	40.0 W	18	34	38	10 NM	50	1012.0	13.0	16.0	12	8	34	< 6	8
AMERICAN RACER	KNDF	22	41.6 N	57.5 W	18	23	40	5 NM	01	0998.0	20.6	15.0	4	10	24	< 6	6.5
AMERICAN ARGOSY	KFCX	23	45.3 N	54.0 W	18	29	35	10 NM	02	0992.5	5.3	3.9	5	10			
AMERICAN ARGOSY	KFCX	24	45.2 N	57.0 W	00	31	39	10 NM	01	0998.5	3.3	3.3	3	6.5	32	< 6	13
ULTRASEA	WJCG	24	58.7 N	01.8 W	06	30	35	1 NM	10	1018.3	8.9	4.4	4	5	30	< 6	6.5
SEALAND ECONOMY	WNDJ	24	44.3 N	38.5 W	12	14	35	10 NM	03	1004.4	15.0	16.1	5	3	14	9	6.5
AMERICAN ARCHER	KFCS	24	44.5 N	55.5 W	18	29	35	5 NM	02	0994.5	3.4	4.4	5	8	29	10	19.5
BUNGA CHEMPAKA	9MTR	25	41.4 N	56.6 W	06	27	23	> 25 NM	01	1002.0	11.0	17.0	10	24.5	23	< 6	6.5
SEALAND ECONOMY	WNDJ	25	40.6 N	48.3 W	12	27	35	10 NM	01	1002.4	15.6	17.2	4	3	27	10	10
ADM WM M CALLAGHAN	KGYE	26	51.0 N	29.5 W	00	09	35	5 NM	03	1014.5	12.2	10.6	5	8	17	7	10
LAKE SHASTA	5NQL	26	39.8 N	52.2 W	12	21	45	2 NM	81	0999.5	21.0		8	6.5			
ARGONAUT	KFDV	27	40.8 N	42.1 W	06	18	50	2 NM	02	1013.5	.		4	10	19	< 6	8
ULTRASEA	WJCG	27	55.8 N	35.3 W	18	11	35	5 NM	02	1009.5	9.5	4.5	5	5	11	< 6	6.5
GREAT LAKES VESSELS																	
GEORGE M HUMPHREY	9B1G	11	45.7 N	86.1 W	06	20	M 38	10 NM	81		6.0	6.0	4	5			
CHARLES M WHITE	9B6G	19	41.7 N	87.4 W	00	01	M 39	10 NM	15		3.0	8.0	4	6.5			
J BURTON AYERS	9B2G	31	43.7 N	87.3 W	00	29	M 48	50 YD	18		1.0	6.0	5	5			
HERBERT C JACKSON	9B9J	31	47.5 N	87.5 W	12	36	M 36	5 NM	63		3.0	7.0	6	6.5			
WILLIAM CLAY FORD	9B8B	31	44.0 N	82.6 W	18	25	M 35	10 NM	01		17.0	8.0		5			
CHAMPLAIN	9B0A	31	43.3 N	82.4 W	18	26	M 35	10 NM	02		17.0	12.0	3	5			
		JUNE															
GARTHNEWYDD	GUJR	2	41.0 N	49.2 W	18	25	35	2 NM	63	1014.0	.	16.0	3	8	25	< 6	13
GARTHNEWYDD	GUJR	3	40.0 N	51.2 W	18	24	35	5 NM	60	1012.0	.	22.0	2	6.5	22	< 6	13
DALAMAN	TCCH	6	34.4 N	49.7 W	02	18	47	1 NM	54	1014.2	21.0	20.0	3	26			
DRUCILLA U	ELMN	6	29.9 N	50.8 W	06	18	36	2 NM	59	1007.5	24.5	22.0	6	8	18	6	13
BAYAMON	WIAG	7	36.2 N	72.0 W	18	21	35	5 NM	02	1016.6	26.7	17.8	2	8	23	< 6	10
DORIC	3FYT	8	37.4 N	70.2 W	12	20	M 35	5 NM	59	1008.0	20.0	22.0	7	11.5			
ROSE CITY	WGJP	9	38.5 N	65.9 W	00	23	35	1 NM	64	1003.7	19.4	18.0	7	6.5	21	< 6	19.5
DALAMAN	TCCH	9	33.7 N	70.3 W	06	25	40	5 NM	13	1010.5	24.0	22.0					
AMERICAN ACE	KFCV	9	39.3 N	60.9 W	12	20	35	2 NM	15	1006.4	22.7	21.1	4	11.5	20	8	16
SEALAND ECONOMY	WNDJ	9	42.4 N	61.0 W	17	27	35	10 NM	00	1004.7	13.9	15.0	3	6.5	23	8	11.5
ANTE TOPIC	6ZBN	14	36.9 N	66.8 W	18	18	40	1 NM	60	1010.0	22.5	22.0	5	8	14	< 6	8
KENNETH E HILL	D5OD	15	36.1 N	74.5 W	06	22	M 40	> 25 NM	00	1014.0	21.5		5	5			
AMERICAN CHALLENGER	WMEP	15	40.5 N	66.9 W	12	32	35	2 NM	58	0995.5	17.2	14.4	6	19.5	32	6	19.5
DORIC	3FYT	15	37.3 N	70.1 W	12	25	M 35	10 NM	01	1012.0	23.0	23.5	6	10			
C V STAGHOUND	KAFQ	15	40.5 N	66.8 W	18	26	35	5 NM	02	1007.5	15.0	15.6	7	6.5	18	< 6	13
AMERICAN ARCHER	KFCS	16	43.3 N	57.6 W	06	25	35	200 YD	45	1007.5	11.2	6.6	7	11.5	25	7	11.5
SEALAND CONSUMER	WCHF	16	38.0 N	59.2 W	18	23	35	10 NM	02	1019.5	26.1	21.7	5	8	23	6	16.5
AMERICAN RACER	KNDF	17	40.7 N	37.0 W	06	24	40	2 NM	02	1016.5	14.0	12.7	4	13	24	8	14.5
MALLORY LYKES	KLPN	17	48.7 N	06.0 W	06	25	40	10 NM	02	1010.8	15.0	12.2	3	8	25	< 6	16.5
AMERICAN LEGACY	KFGJ	18	49.3 N	34.2 W	00	24	35	5 NM	05	1013.9	12.8	14.4	3	5	25	6	10
ADM WM M CALLAGHAN	KGYE	18	53.3 N	32.1 W	12	28	40	5 NM	25	1014.0	8.9	9.4	6	16.5	28	9	26
PIONEER CONTENDER	WMEC	18	55.7 N	21.4 W	18	24	50	2 NM	07	0993.6	10.0	12.3	6	36	24	8	29.5
PIONEER CONTENDER	WMEC	19	54.6 N	22.6 W	00	27	50	5 NM	02	1006.0	10.4	12.7	8	32.5	24	8	32.5
AMERICAN ACE	KFCV	19	49.8 N	17.4 W	12	28	35	10 NM	02	1023.7	14.4	14.0	4	10	29	6	14.5
SEALAND ECONOMY	WNDJ	19	48.8 N	09.8 W	18	28	45	10 NM	02	1019.0	13.3	15.0	6	10	28	7	16.5
SEALAND ECONOMY	WNDJ	20	48.5 N	12.4 W	00	28	40	10 NM	02	1022.7	12.2	14.4	6	10	28	7	16.5
GEORGE M KELLER	5MVV	20	40.2 N	11.5 W	18	02	M 35	10 NM	02	1025.0	17.0	18.3			02	< 6	13
ARGONAUT	KFDV	23	39.5 N	57.8 W	06	18	40	5 NM	07	1029.8	22.2	22.8	5	10	18	< 6	16.5
OCEAN GOLF	D5XA	23	49.1 N	14.0 W	21	32	M 40	5 NM	01	1007.0	11.0	14.0	5	6.5	30	8	14.5
OCEAN GOLF	D5XA	24	48.2 N	21.3 W	15	27	M 35	2 NM	02	1015.6	13.6	14.5	5	8	28	10	23

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10s	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10s	Swell Waves Period sec.	Swell Waves Height ft.
NORTH ATLANTIC OCEAN		JUNE															
EXPORT PATRIOT	WDJY	25	36.9 N	51.5 W	12	34	35	10	RW	02	1016.3	21.1	21.1	2	5	34	< 6	10
DELTA VENEZUELA	KRFC	27	14.4 N	74.3 W	18	09	35	10	RW	02	1013.0	31.2	25.6	3	6.5	10	< 6	6.5
EXPORT BUYER	KCAQ	27	38.4 N	63.4 W	18	22	35	10	RW	16	1013.9	26.7	24.5	7	10	21	7	13
DELTA VENEZUELA	KRFC	28	12.2 N	74.3 W	00	09	35	10	RW	03	1010.0	26.7	25.6	3	6.5	09	6	10
OCEAN GOLF	DSKA	28	37.7 N	55.9 W	12	20	M 41	10	RW	60	1013.5	22.8	23.9	5	10	22	7	19.5
TRANSOCEANICA SILVIA	ICWL	30	11.3 N	75.1 W	12	06	40	5	RW	02	1010.9	27.8	27.0		19.5			
GREAT LAKES VESSELS																		
MESABI MINER	WB87	8	44.4 N	87.3 W	06	34	M 37	10	RW	01		6.0	5.0	3	6.5			
T W ROBINSON	WB21	10	45.7 N	86.4 W	00	35	M 42	10	RW	01		10.0	7.0		5			
GEORGE M HUMPHREY	WB16	13	47.3 W	86.7 W	06	16	P 35	5	RW	18		6.0	7.5					
CASON J CALLAWAY	WB41	19	43.4 N	86.9 W	18	35	M 36	10	RW	02		4.0	5.0	3	8			
HERBERT C JACKSON	WB97	19	44.0 N	86.6 W	18	36	M 45	5	RW	02		8.0	6.0	6	6.5			
GEORGE A SLOAN	WB17	20	46.2 N	82.5 W	00	01	M 40	5	RW	52		1.0	0.0		6.5			
ENVIRONMENTAL BUOYS																		
44004		15	39.0N	70.0W	06	29	MM1			1007.0	16.4	17.8	7	13				

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Continued from page 451.

MAY 44005

D A T A S U M M A R Y

AVERAGE LATITUDE 50.0N AVERAGE LONGITUDE 065.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	16.4	(09 15)	20.8	23.6	(13 15)	102	13
SEA TEMP (DEG C)	19.2	(01 15)	21.0	23.8	(12 21)	102	13
AIR-SEA TEMP (DEG C)	-04.6	(09 15)	-00.2	01.4	(06 03)	102	13
PRESSURE (MBAR)	1008.3	(09 09)	1013.6	1019.4	(12 15)	102	13

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.0	3.0	5.0	1.0			10.0	11.6
NE		3.0	2.0				5.0	11.6
E	1.0	4.0	4.0				8.9	8.0
SE	2.0	11.9	3.0				16.9	7.8
S	3.0	9.9	4.0				16.9	8.2
SW		5.0	8.9				13.9	11.8
W	1.0	9.9	12.9				23.8	11.1
NW		3.0	2.0				5.0	9.8
CALM	2.0						2.0	.0
TOTAL	9.9	49.5	39.6	1.0			100.0	9.4

NO. OF OBS: 101

MAX WIND
SPEED: 24 KNOTS
DIRECTION: 020 DEG
DAY: 09
HOUR: 12

JUNE 45005

D A T A S U M M A R Y

AVERAGE LATITUDE 41.7N AVERAGE LONGITUDE 082.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.1	(30 15)	21.2	24.6	(27 00)	57	8
SEA TEMP (DEG C)	18.5	(24 09)	20.4	22.8	(27 03)	57	8
AIR-SEA TEMP (DEG C)	-02.5	(30 15)	00.7	05.3	(27 00)	57	8
PRESSURE (MBAR)	1012.0	(29 21)	1017.1	1018.3	(24 18)	57	8

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		8.8					8.8	9.4
NE		17.5					17.5	9.3
E	7.0	12.3					19.3	9.3
SE	3.5	5.2					8.8	5.8
S	7.0	8.8					15.8	8.5
SW	1.8	8.5	1.8				12.3	6.1
W	1.8	10.5	1.8				14.0	8.0
NW		1.8	8.8				10.5	14.5
CALM								
TOTAL	21.1	66.7	12.3				100.0	8.2

NO. OF OBS: 97

MAX WIND
SPEED: 18 KNOTS
DIRECTION: 300 DEG
DAY: 30
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 56

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	67.5	17.5							.99	1.5M (30 03)

MAY 44003

D A T A S U M M A R Y

AVERAGE LATITUDE 42.7W AVERAGE LONGITUDE 068.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.0	(03 06)	08.9	13.9	(22 21)	220	28
SEA TEMP (DEG C)	06.8	(02 12)	08.7	11.5	(24 21)	220	26
AIR-SEA TEMP (DEG C)	-02.1	(20 21)	00.2	04.8	(23 06)	220	28
PRESSURE (MBAR)	0998.6	(04 09)	1010.9	1030.4	(17 18)	220	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.6	2.3				5.9	9.8
NE	.5	6.8	5.0	.9			13.2	12.0
E		6.8	4.1	.9			11.8	11.3
SE	1.4	2.3	1.4				5.0	7.7
S	.5	5.5	5.5				11.4	10.8
SW	1.4	8.2	10.5				20.0	10.6
W	.5	11.4	7.3				19.1	9.8
NW	.9	7.3	4.5				12.7	8.6
CALM	.9						.9	.0
TOTAL	5.9	51.8	40.5	1.8			100.0	10.2

NO. OF OBS: 320

MAX WIND
SPEED: 24 KNOTS
DIRECTION: 060 DEG
DAY: 02
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 134

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	33.6	54.5	9.0	2.2	.7				1.1M	4.0M (03 06)

MAY 44004

D A T A S U M M A R Y

AVERAGE LATITUDE 40.7N AVERAGE LONGITUDE 137.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
PRESSURE (MBAR)	1000.0	(05 03)	1019.8	1030.0	(02 15)	167	21

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.6	7.2	10.2	1.8			19.8	12.7
NE		1.8	.6				2.4	7.8
E	2.4	1.2					3.6	3.5
SE	.6	3.6	1.8				6.0	9.3
S	.6	.6	1.8	1.8			4.8	18.3
SW		2.4	13.2	1.2			16.8	14.9
W		2.4	16.2	4.2			22.8	15.5
NW		7.2	11.4	4.2			22.8	15.4
CALM	1.2						1.2	.0
TOTAL	5.4	26.3	58.1	13.2			100.0	13.8

NO. OF OBS: 167

MAX WIND
SPEED: 31 KNOTS
DIRECTION: 170 DEG
DAY: 02
HOUR: 21

Selected Gale and Wave Observations, North Pacific

May and June 1980

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C. Air	Temperature °C. Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		MAY															
OCEAN GOLF	DSXA	1	52.7 N	137.5 W	00	19	N 27	1 NM	02	1009.1	7.6	7.0	3	6.5	23	8	29.5
MILLYER BROWN	KHLA	1	40.5 N	124.9 W	00	35	35	10 NM	02	1012.2	12.2	11.7	6	10	34	6	13
MAUNALEI	KSVE	1	40.2 N	124.5 W	00	33	N 42	5 NM	00	1007.3	11.7	11.1	7	6.5	31		6.5
SEALAND PATRIOT	KHRF	1	36.1 N	146.9 E	06	09	N 37	.5 NM	61	0995.8	16.5	19.0	7	11.5	09	9	14.5
NORSE PILOT	GDVG	1	39.2 N	175.1 W	12	22	43	2 NM	65	1012.0	10.8	12.0	6	26	22	< 6	49
SEATRAIN VALLEY FORGE	9VPV	1	38.3 N	168.0 W	12	20	N 38	5 NM	02	1024.5	11.0	12.0					
MARINER	SLEF	1	39.0 N	151.5 E	20	07	45	1 NM	80	0991.4	13.0	13.0	5	13	08	< 6	13
SEALAND PATRIOT	KHRF	2	37.3 N	154.3 E	00	23	40	5 NM	02	0997.7	21.5	15.0	7	10	XX		14.5
EVER VALUE	H3NH	2	42.8 N	175.9 W	00	29	N 35	5 NM	80	1013.6	9.0	8.0	7	13	28	13	16.5
VAN TRIUMPH	6ZJP	2	46.3 N	160.2 W	00	19	N 42	2 NM	61	1001.0	5.0	5.0					
SILVER PHOENIX	DSNW	2	40.7 N	153.3 E	00	11	N 35	5 NM	11	0992.6	10.0	6.0	9	18	11	6	11.5
ASIA BRAVERY	ABCM	2	41.6 N	151.8 E	06	05	N 48	200 YD	45	0992.0	7.0	6.0	4	6.5	07	9	13
GREEN KOBE	JNBY	2	42.8 N	153.1 E	12	04	N 43	200 YD	28	0993.5	5.0	7.0	5	14.5	04	8	16.5
MARINER	SLEF	2	40.3 N	155.9 E	16	26	35	2 NM	02	0989.0	7.0	6.0	7	14.5	07	< 6	13
GENISTA	H3XV	3	43.1 N	171.5 E	00	13	N 42	.25 NM	64	1004.0	6.0	6.0	7	14.5	13	8	16.5
SEALAND DEFENDER	KGJB	3	53.9 N	158.0 W	00	06	N 35	10 NM	02	1001.0	9.5	5.0	5	16.5	06	< 6	13
MARINER	SLEF	3	40.9 N	158.3 E	01	26	35	2 NM	80	0988.0	9.0	6.0	6	13	14	>13	8
SEALAND LEADER	WSNH	3	43.2 N	163.9 W	06	33	N 35	10 NM	03	1018.5	5.0	6.0	6	10	32	7	11.5
SEALAND COMMERCE	WEUJ	3	44.0 N	152.2 E	06	35	45	5 NM	02	1012.2	3.9	0.0	6	11.5	09	8	16.5
PRESIDENT JACKSON	KADB	3	43.9 N	175.2 E	06	13	35	2 NM	63	0998.0	6.1	3.4	9	36			
YAMASHIN MARU	JBES	3	38.1 N	155.2 W	18	33	N 36	10 NM	02	1019.5	9.5	11.0	6	10	29	9	19.5
SEATRAIN YORKTOWN	DSNP	3	35.3 N	142.5 W	18	11	N 43	2 NM	03	1010.5	15.5	15.0	6	8	23	8	8
VAN TRIUMPH	6ZJP	3	48.3 N	145.1 W	18	11	N 35	2 NM	51	1001.0	8.0	6.0					
WORLD CANDOUR	SMOI	3	42.6 N	165.1 E	18	32	N 36	2 NM	40	1004.5	4.0	6.0	12	16.5	31	12	16.5
SEATRAIN VALLEY FORGE	9VPV	3	38.4 N	173.0 E	18	24	N 37	5 NM	18	1006.5	13.0	13.0	5	6.5	29	8	16.5
SEATRAIN VALLEY FORGE	9VPV	4	38.4 N	171.8 E	00	27	N 40	2 NM	18	1009.0	13.0	14.0	5	8	27	8	18
BELLMAN	9VUP	4	35.0 N	168.3 E	00	29	N 42	5 NM	60	1018.0	16.0	16.0	6	11.5	28	9	16.5
WORLD CANDOUR	SMOI	4	42.0 N	166.7 E	00	32	N 35	5 NM	02	1013.5	5.0	6.5	12	16.5			
VAN TRIUMPH	6ZJP	4	48.7 N	145.0 W	00	11	N 45	2 NM	51	0999.5	6.0	6.0					
SEATRAIN YORKTOWN	DSNP	4	35.6 N	149.3 W	00	29	N 37	10 NM	02	1015.0	13.0	14.0	8	16.5	30	>13	23
DIAMOND PHOENIX	DSMS	4	34.5 N	149.4 W	00	32	N 38	5 NM	03	1019.5	13.0	15.5	8	8	32	8	10
TOYOTA MARU 10	JKPI	4	49.3 N	174.1 W	00	14	N 37	1 NM	03	0999.5	4.0	2.0	6	10	14	10	16.5
PERENNIAL ACE	HOMG	4	45.4 N	139.5 W	00	12	N 46	1 NM	63	0999.5	8.0	9.0	7	10	12	8	11.5
MARINER	SLEF	4	43.3 N	165.5 E	04	36	35	10 NM	02	1017.7	8.5	3.0	6	8	02	7	8
PRESIDENT JACKSON	KADB	4	43.8 N	177.4 W	06	22	25	5 NM	03	1000.0	11.7	5.0	3	6.5	18	9	29
EVER VALUE	H3NH	4	41.3 N	152.3 W	12	31	N 37	5 NM	02	1019.0	3.0	3.0					
MARUNA MARU	JJKQ	4	38.6 N	148.9 W	12	29	N 35	10 NM	02	1013.0	9.0	12.0	4	10			
PRESIDENT MADISON	WCIP	4	46.9 N	158.7 E	12	27	35	5 NM	02	1016.5	4.4	0.0	4	10	XX		13
SIENA	DXFU	4	35.6 N	143.9 W	12	30	N 41	5 NM	80	1014.0	10.8	11.0					
EASTERN DIAMOND	HODT	4	37.5 N	143.0 E	12	22	N 45	5 NM	03	1010.0	16.0	13.0	4	10	22	< 6	13
PRESIDENT TRUMAN	WLRL	4	36.6 N	144.2 W	18	28	35	10 NM	15	1015.6	11.6	13.4	6	6.5	28	8	16.5
NOPAL VERDE	JXLN	4	34.9 N	145.5 W	18	29	N 36	5 NM	03	1014.2	10.0	12.5	6	8	30	10	19.5
SEALAND DEFENDER	KGJB	4	52.6 N	179.2 E	18	34	N 40	2 NM	61	0995.5	2.4	4.0	11	23			
EVER VALUE	H3NH	5	40.2 N	147.9 W	00	31	N 35	5 NM	02	1018.0	8.0	3.0	7	16.5	33	13	26
PRESIDENT TRUMAN	WLRL	5	35.8 N	146.6 W	00	30	35	10 NM	01	1020.5	13.4	13.4	5	10	30	6	23
SEALAND LEADER	WSNH	5	40.0 N	148.3 W	00	30	N 36	10 NM	02	1016.5	11.1	10.0	6	10	33	10	10
SEATRAIN YORKTOWN	DSNP	5	35.4 N	147.9 W	00	29	N 38	10 NM	02	1022.0	16.0	12.0	7	13	32	10	24.5
VAN TRIUMPH	6ZJP	5	48.4 N	142.2 W	00	04	N 35	5 NM	51	0999.0	7.0	7.0					
PRESIDENT TAFT	WLDT	5	36.6 N	137.1 W	12	27	40	10 NM	02	1015.9	12.2	12.8	3	8	29	>13	13
CHEVRON WASHINGTON	KFDB	5	34.8 N	139.2 W	12	10	N 35	5 NM	21	1004.0	5.4		3	10	18	7	6.5
WESTWARD VENTURE	KHJB	5	56.3 N	142.0 W	12	10	N 35	10 NM	03	1004.5	6.7	6.1					
SEALAND DEFENDER	KGJB	5	49.0 N	163.8 E	18	11	N 35	200 YD	73	0995.8	2.0	3.0	3	10			
MARINER	SLEF	5	45.9 N	175.8 E	18	32	35	10 NM	01	1015.0	5.0	3.0	4	5	32	< 6	5
VAN WARRIOR	5MEV	5	44.8 N	152.4 E	18	27	35	10 NM	03	0998.0	2.0	2.0					
SEATRAIN VALLEY FORGE	9VPV	5	36.5 N	158.4 E	18	19	N 42	2 NM	62	1009.0	17.0	15.0	4	10	20	8	13
HANJIN INCHEON	D8OC	5	45.4 N	136.0 W	20	26	N 20	5 NM	02	1010.0	11.0	10.0	3	5	25	11	26
SEATRAIN VALLEY FORGE	9VPV	6	36.1 N	156.3 E	00	20	N 42	1 NM	62	1003.0	18.5	17.0	5	10	20	8	21
VAN WARRIOR	5MEV	6	44.1 N	151.2 E	00	33	44	5 NM	03	1002.0	3.0	2.0	8	18	26	>13	28
BELLMAN	9VUP	6	35.2 N	155.4 E	00	23	N 40	.5 NM	62	1001.5	19.5	14.0	5	18	34	6	16.5
NORSE PILOT	GDVG	6	33.0 N	153.7 E	12	24	35	2 NM	50	1004.0	18.8	18.0	6	13	23	6	32.5
PRESIDENT MADISON	WCIP	6	36.4 N	142.2 E	12	28	35	5 NM	02	1004.0	15.0	12.2	4	6.5			
GLOBAL FRONTIER	H3AU	6	33.8 N	121.2 W	18	34	N 38	5 NM	00	1018.0	14.5	13.0	5	18	34	6	14.5
GLOBAL FRONTIER	H3AU	7	33.7 N	122.4 W	00	34	N 35	5 NM	00	1019.0	14.0	14.0	5	18	34	6	16.5
EASTERN FRIENDSHIP	H8LR	7	43.9 N	179.4 W	00	22	N 39	50 YD	43	0999.5	10.0		12	8	22	< 6	8
MARINER	SLEF	7	47.8 N	174.2 W	00	22	35	.5 NM	80	0997.0	8.5	3.0	4	6	22	6	10
SEATRAIN VALLEY FORGE	9VPV	7	35.1 N	149.0 E	00	29	N 38	5 NM	03	1002.0	16.0	19.0	6	10	XX	7	11.5
BELLMAN	9VUP	7	38.0 N	150.3 E	06	30	N 60	2 NM	02	1009.0	13.0	18.5	6	13	30	9	16.5
SAMOA	OXTZ	7	48.7 N	178.9 W	12	29	35	10 NM	01	1000.0	3.3	5.5	5	13			
PERENNIAL ACE	HOMG	7	51.3 N	172.8 W	15	26	N 40	5 NM	25	0986.0	4.5	4.0	7	10	26	7	13
EXXON NEW ORLEANS	WNDM	7	52.0 N	136.9 W	18	17	40	5 NM	41	1004.4	6.7	7.7	5	5	18	8	11.5
SAMOA	OXTZ	8	49.4 N	174.3 W	00	29	35	10 NM	02	1007.2	5.5	6.5	5	16.5			
SEALAND FINANCE	WJKG	8	50.6 N	166.1 W	00	29	38	10 NM	10	0993.8	5.6	2.8	9	13	24	11	23
MARINER	SLEF	8	50.3 N	165.1 W	02	27	35	5 NM	03	0996.0	7.0	3.0	10	13	27	7	10
WESTWARD VENTURE	KHJB	8	56.2 N	141.5 W	06	21	N 40	5 NM	55	0995.0	3.3	5.6	7	13	19	6	13
PACIFIC VENTURE	HGVS	8	43.6 N	174.8 W	12	21	N 35	2 NM	12	1000.0	10.0	10.0	10	18	21	10	19.5
AMERICA SUN	WNEJ	8	59.2 N	144.8 W	12	11	N 48	2 NM	01	0999.0	5.6	5.6	2	6.5	11	10	13
BUNGA MELAWIS	9MUT	8	51.2 N	150.0 W	12	28	N 35	2 NM	51	0993.0	5.0	5.0					
VAN CONQUEROR	A8IB	8	35.5 N	141.1 E	18	16	N 35	5 NM	02	1012.0	17.0	22.0					
PRESIDENT TYLER	WEZM	8	36.4 N	143.2 E	18	20	N 44	10 NM	02	1017.0	18.3	20.6					
CHEVRON ARIZONA	KGBE	8	43.4 N	135.4 W	18	24	N 35	2 NM	80	1010.5	10.0		4	6.5	27	6	11.5
HANJIN INCHEON	D8OC	8	52.8 N	165.8 W	22	14	N 17	5 NM	02	1003.5	6.0	4.0	3	5	22	12	26
VAN CONQUEROR	A8IB	9	36.4 N	142.6 E	00	20	N 47	2 NM	50	1010.0	15.0	22.0	7	13			
SEATRAIN LEXINGTON	DWFC	9	31.9 N	137.2 E	00	21	35	2 NM	50	1006.0	21.6	20.7	5	5	19		10
VAN WARRIOR	5MEV	9	33.9 N	137.4 E	00	25	35	.5 NM	25	1002.0	18.0	18.0	5	11.5	18	10	16.5
SEALAND MCLEAN	WHGA	9	48.7 N	163.7 E	00	29	35	10 NM	01	1011.0	3.3	4.6	5	8	29	8	10
AMERICA SUN	WNEJ	9	55.9 N	140.9 W	06	11	N 35	5 NM	03	1002.7	5.5	5.5	2	6.5	12	8	11.5
PACMERCHANT	SMCB	9	51.1 N	165.8 E	06	26	N 36	10 NM	03	1008.5	3.3	3.0	5	5	28	7	11.5
ALSTER EXPRESS	DIDL	9	36.8 N	142.5 E	06	14	37	2 NM	63	0997.0	18.3	21.0	6	11.5			
PACIFIC ACE	H3YP	9	34.4 N	147.7 E	12	20	N 35	.5 NM	47	1007.0	19.0	20.0	7	10	20	7	13
OVERSEAS CHICAGO	KBCF	9	46.9 N	131.7 W	18	31	35	> 25 NM	02	1003.2	9.4	10.0	4	5	31	9	14.5
PRESIDENT TYLER	WEZM	9	38.4 N	154.2 E	18	19	N 55	200 YD	02	1005.0	15.6	15.6					
BUNGA MELAWIS	9MUT	9	52.1 N	159.2 W	18	23	N 35	2 NM	05	1000.0	5.5	3.5	8	6.5	23	13	6.5
HANJIN INCHEON	D8OC	9	51.1 N	177.0 W	22	28	N 40	5 NM	02	0993.0	6.0	4.0	6	10	27	11	36
DIAMOND PHOENIX	DSMS	10	36.4 N	158.8 E	06	23	N 50	2 NM	61	1004.0	19.5	19.0	6	19.5	20	8	19.5

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10s	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10s	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		MAY															
BUNGA MELAWIS	9MUT	10	52.3 N	161.8 W	06	23	N 42	2 NM	07	0996.0	4.5	3.0	8	8	23	13	10
PACMERCHANT	SMCB	10	48.1 N	158.1 E	06	35	N 60	.25 NM	73	0984.0	- 2.0	1.5	4	5	35	8	10
RED ARROW	SLTY	10	48.5 N	159.0 E	12	33	N 40	1 NM	73	0988.0	1.0	2.2	5	16.5			
FLORA ISLAND	JCMI	10	51.1 N	164.2 E	12	17	N 40	1 NM	72	0990.6	2.0	2.5	3	5	18	6	8
PERENNIAL ACE	HOMQ	10	47.2 N	159.2 E	12	31	N 53	2 NM	62	0983.5	2.5	2.0	5	18	31	9	19.5
OLGA MAERSK	OUXW	10	43.5 N	167.3 E	12	29	35	5 NM	42	0999.0	6.0		7	11.5			
CRYSTAL STAR	DSTG	10	53.9 N	158.1 W	12	20	N 42	2 NM	02	1002.0	3.0	4.0	5	10	20	10	32.5
SOUTH EXPRESS	ABWR	10	53.9 N	176.8 W	12	28	N 40	2 NM	60	0996.0	3.0	5.0					
NEPTUNE CRYSTAL	9VNW	10	45.3 N	170.2 E	18	26	N 36	5 NM	02	0989.5	4.5	3.0	5	19.5	20	< 6	19.5
PRESIDENT JOHNSON	WWHS	10	50.4 N	161.0 E	18	36	35	.5 NM	73	0993.5	5.1	2.7	5	8	02	8	14.8
HANJIN INCHEON	D8OC	10	50.1 N	172.8 E	23	19	N 28	5 NM	02	0978.0	4.5	4.0	4	6.5	18	9	32.5
EASTERN FORTUNE	ELNZ	11	48.6 N	176.9 W	00	18	N 35	1 NM	59	1013.5	10.2		8	13			
NEPTUNE CRYSTAL	9VNW	11	48.3 N	172.6 E	00	24	N 44	2 NM	02	0990.2	4.9	8.0	8	23	22	8	26
BUNGA MELAWIS	9MUT	11	52.4 N	165.5 W	00	25	N 36	2 NM	05	1005.0	5.8	4.0	3	13	24	12	16.5
SUCCESSFUL VENTURE	SLNJ	11	49.4 N	165.5 E	00	35	N 42	1 NM	10	0998.3	4.8	3.0	6	19.5	33	9	14.8
STAR HONGKONG	ZCKP	11	51.5 N	168.6 E	06	04	36	5 NM	02	0988.8	3.0		5	6.5	05	7	11.5
CRYSTAL STAR	DSTG	11	54.2 N	163.5 W	06	21	N 40	5 NM	02	1005.0	6.0	4.0	5	11.5	21	10	32.5
PRESIDENT JEFFERSON	WPGE	11	43.8 N	170.2 E	12	30	40	5 NM	41	1003.5	3.9	1.7					
OLGA MAERSK	OUXW	11	44.5 N	175.2 E	12	23	35	5 NM	02	0996.0	5.0		9	16.5			
SKAUGRAN	LHUK	12	51.0 N	178.5 E	00	02	25	10 NM	22	0995.0	4.0		6	10	23	>13	29.5
PRESIDENT JEFFERSON	WPGE	12	45.7 N	176.0 E	00	29	35	5 NM	41	1085.7	5.0	3.3	14	23			
HANJIN INCHEON	D8OC	12	47.1 N	163.1 E	00	29	N 25	5 NM	02	1014.5	3.0	5.0	4	6.5	28	8	26
CHEVRON ARIZONA	KGBE	12	52.2 N	157.9 W	06	14	N 35	.5 NM	80	1014.2	5.0		3	13	24	< 6	14.5
SIENA	OXFU	12	27.8 N	156.9 E	18	18	N 36	> 25 NM	02	1020.0	19.6	24.0			04	6	3
CRYSTAL STAR	DSTG	12	54.3 N	177.4 W	18	32	N 38	10 NM	02	0998.0	3.8	4.5	8	18	32	10	24.5
PRESIDENT TYLER	WEZM	14	42.0 N	156.2 W	12	20	N 45	.25 NM	42	1005.5	8.3	7.8					
AMERICA SUN	WAEJ	14	39.4 N	124.6 W	18	33	N 40	> 25 NM	01	1015.0	11.0	12.3	5	8	32	9	11.5
PRESIDENT TYLER	WEZM	15	41.6 N	151.2 W	00	19	N 45	2 NM	42	1002.5	11.1	7.8	7	29.5	19	9	32.5
STREAM HAWSER	ELUN	15	41.1 N	150.1 W	00	27	N 18	2 NM	12	1010.2	15.9	10.3	10	19.5	27	7	24.5
PERENNIAL ACE	HOMQ	15	37.6 N	148.9 E	03	21	N 37	2 NM	02	1006.0	24.0	23.0	4	6.5	19	6	8
MANULANI	KNIJ	15	32.9 N	120.7 W	06	29	45	5 NM	02	1012.2	14.4	15.6	4	14.5	29	9	13
STAR HONGKONG	ZCKP	15	37.7 N	149.4 E	06	19	35	5 NM	50	1003.0	2.2		7	8	19	7	6.5
SUCCESSFUL VENTURE	SLNJ	15	41.5 N	140.1 E	06	21	N 43	2 NM	18	1003.3	22.0	20.0	3	11.5	02	10	6.5
ORIENTAL EXPORTER	VRCH	15	49.7 N	147.3 W	18	18	50	2 NM	53	0985.0	6.0	6.0	10	16	17	9	14.5
KOREAN PRIDE	ELHF	16	50.1 N	157.2 W	00	29	N 40	5 NM	02	0992.1	4.0	4.0	4	8	29	< 6	8
STREAM HAWSER	ELUN	16	41.4 N	156.0 W	00	31	N 33	5 NM	01	1017.3	9.3	9.5	8	26	27	6	29.5
CRYSTAL STAR	DSTG	16	40.2 N	154.0 E	06	25	N 48	10 NM	02	0996.0	3.0	0.0	5	16.5	25	10	32.5
VAN CONQUEROR	A8IB	16	50.9 N	157.1 W	06	32	N 35	2 NM	02	0992.0	6.0	5.0			34	9	19.5
TAURUS	WDZW	16	26.0 N	124.6 E	06	02	N 38	5 NM	81	1011.5	21.5	25.6	6	13	34	8	16.5
GLACIER BAY	KACF	16	54.4 N	149.9 W	06	09	40	10 NM	02	0990.2	5.5	2.8	8	32.5	XX		32.5
PRESIDENT ADAMS	KAAV	16	52.5 N	146.4 W	18	18	47	5 NM	63	0992.6	5.0	5.6	6	16.5	18	9	23
SEALAND EXCHANGE	KFOU	16	51.3 N	143.9 W	18	22	35	2 NM	01	1000.8	6.7	4.4	5	5	22	9	11.5
SEALAND DEFENDER	WGJ_	16	27.7 N	125.2 E	18	03	N 35	10 NM	51	1011.9	19.5	27.0	5	13	03	< 6	19.5
PRESIDENT PIERCE	WUPV	16	54.0 N	177.9 E	18	26	35	5 NM	02	0977.0	2.8	1.7	5	13	29	< 6	13
VAN TRIUMPH	6ZJP	16	50.6 N	144.7 W	18	21	N 40	5 NM	80	1000.0	6.0	7.0					
NEPTUNE DIAMOND	9VYT	16	24.9 N	120.4 E	18	05	N 36	5 NM	02	1011.0	20.5						
VAN TRIUMPH	6ZJP	17	50.3 N	145.8 W	00	21	N 38	5 NM	02	1004.5	8.0	6.0					
KOREAN PRIDE	ELHF	17	48.9 N	146.6 W	00	23	N 39	5 NM	02	1002.2	8.0	6.0	4	6.5	23	< 6	8
MARITIME TRADER	3EJX	17	52.5 N	169.5 E	00	25	N 41	2 NM	21	0973.0	7.5	5.0	14	29.5	23	11	24.5
PRESIDENT ADAMS	KAAV	17	52.3 N	147.2 W	00	23	45	5 NM	02	0996.3	5.6	4.4	6	14.5	23	8	23
EASTERN ROYAL	JMZR	17	49.4 N	172.5 E	00	24	N 46	2 NM	02	0989.5	4.0	3.0	8	16.5			
TOYOTA MARU 10	JABI	17	53.8 N	178.9 W	00	23	N 37	5 NM	02	0978.0	6.0	2.5	4	8	23	8	11.5
SIENA	OXFU	17	22.6 N	125.7 E	06	04	N 40	5 NM	62	1002.5	25.2		12	10	17	< 6	13
SILVER STAR	JKIG	17	53.7 N	177.4 E	06	20	N 50	1 NM	38	0977.5	6.0	6.0	7	6.5	25	8	8
JAPAN APOLLO	JMZL	17	49.6 N	175.6 W	06	26	N 38	5 NM	03	0991.0	8.0		5	8	24	8	13
NEW GOLDEN PHOENIX	3EYN	17	34.7 N	122.0 W	06	31	N 36	10 NM	02	1015.0	13.0	15.0	5	6.5	30	< 6	6.5
ARCTIC TOKYO	5LJT	17	52.1 N	174.6 E	06	25	N 46	5 NM	02	0978.0	4.0	1.0	8	21			
SINCERE NO 3	ELPT	17	46.1 N	175.7 E	06	25	N 35	10 NM	03	1004.0	5.5	3.0	6	18	23	6	19.5
AMERICAN LYNX	WZJE	17	19.2 N	125.5 E	12	25	35	5 NM	02	1002.0	26.7	26.1	4	8	38	7	14.5
PRESIDENT PIERCE	WUPV	17	52.7 N	172.1 E	12	28	40	2 NM	60	0987.0	3.5	2.2	6	14.5	28	8	29.5
PHILADELPHIA	WJGG	17	36.8 N	143.2 W	12	14	35	5 NM	20	1008.5	6.0	8.5	4	10	20	8	16.5
WORLD HERCULES	JKVA	17	53.6 N	155.9 W	22	09	N 27	1 NM	25	0985.2	10.6	4.0			09	9	29.5
EASTERN ROYAL	JMZR	18	50.8 N	178.1 W	00	24	N 37	5 NM	01	0988.5	6.0	4.0	8	14.5	27	13	21
PRESIDENT ADAMS	KAAV	18	54.3 N	154.9 W	00	19	35	2 NM	60	0986.1	2.2	5.0	6	10	19	6	10
LAUREL	H8DE	18	21.9 N	121.2 E	00	03	N 38	10 NM	02	1007.0	26.0	28.0	7	13	03	7	13
SIENA	OXFU	18	21.8 N	120.6 E	00	05	N 35	10 NM	03	1008.0	26.8		12	8	05	< 6	8
SILVER STAR	JKIG	18	53.5 N	176.4 E	06	29	N 45	2 NM	93	0992.0	4.0	4.0	7	8	31	9	10
JAPAN APOLLO	JMZL	18	50.5 N	163.0 W	06	25	N 35	2 NM	03	0986.0	6.5		5	10	25	8	16.5
WESER EXPRESS	OLDE	18	53.5 N	179.6 E	06	01	N 37	5 NM	80	0986.5	2.8	3.0	6	13	29	8	23
SINCERE NO 3	ELPT	18	46.2 N	172.7 W	18	28	N 36	5 NM	02	1013.8	4.0	4.0	4	16.5	30	9	39
VAN TRIUMPH	6ZJP	18	48.0 N	156.9 W	18	27	N 40	10 NM	03	0996.0	7.0	6.0					
GLACIER BAY	KACF	18	43.3 N	153.3 W	18	23	40	5 NM	02	1008.5	10.0	8.1	3	16.5	23	7	21
PRESIDENT GRANT	WEZD	18	35.2 N	149.8 E	18	01	N 37	10 NM	02	1016.9	16.1	15.6	2	10	34	< 6	10
GOLDENSARI	9VNY	18	46.0 N	166.7 W	18	27	36	5 NM	02	1010.0	5.0	7.0	10	6.5	27	13	16.5
MARCONA TRANSPORTER	ELUG	19	16.9 N	137.6 E	00	27	36	> 25 NM	02	1004.0	27.5	29.0	4	6.5	01	9	10
MADANG	ELIJ	19	56.0 N	136.6 W	00	15	35	5 NM	60	1000.3	8.0	- 0.6	15	11.5	15	8	11.5
HANJIN SEOUL	D7ES	19	47.7 N	159.7 W	00	24	N 36	2 NM	62	0998.2	8.1	5.8	9	3	27	10	13
BLESS RIVER	D5PS	19	52.2 N	136.0 W	00	14	N 39	1 NM	80	1001.5	7.8	8.0	6	10	20	8	13
GLACIER BAY	KACF	19	41.4 N	153.3 W	00	23	40	2 NM	10	1013.2	11.1	6.6	6	8	23	8	21
EASTERN ROYAL	JMZR	19	52.2 N	169.1 W	00	29	N 36	5 NM	02	0988.0	7.2	6.0	8	13	27	13	19.5
SILVER STAR	JKIG	19	52.6 N	169.2 E	06	27	N 35	1 NM	10	1001.8	9.0	4.5	8	6.5	29	8	6.5
WESTWARD VENTURE	KHJB	19	55.1 N	138.5 W	06	26	N 35	2 NM	20	0989.8	4.4	8.9					
SINCERE NO 3	ELPT	19	46.0 N	169.0 W	06	28	N 40	10 NM	02	1015.0	4.5	4.0	4	16.5	35	9	39
NEPTUNE AMBER	S6CY	19	42.5 N	162.4 W	12	30	N 32	2 NM	02	1002.2	6.0	5.0	7	8	XX	13	26
VAN TRIUMPH	6ZJP	19	48.9 N	161.7 W	18	27	N 42	10 NM	03	1005.0	7.0	6.0					
SINCERE NO 3	ELPT	20	45.2 N	163.4 W	00	29	N 41	5 NM	08	1016.5	4.5	4.0	5	24.5	30	8	41
SEALAND COMMERCE	WEUJ	20	46.0 N	165.8 E	00	34	36	5 NM	02	1005.2	4.4	2.3	4	8	34	9	14.5
SACRAMENTO	A8DR	20	46.3 N	165.0 E	00	10	N 40	5 NM	03	1012.0	1.0	0.0	6	11.5	11	7	13
VIENNA WOODS	5LOY	20	52.8 N	164.7 W	00	32	N 37	5 NM	01	1003.0	5.0	4.0	13	19.5	32	< 6	10
NEPTUNE AMBER	S6CY	20	43.0 N	170.2 E	06	27	N 44	5 NM	02	1014.0	6.0	5.0	7	8	27	8	24.5
SEALAND FINANCE	WJKG	20	39.7 N	156.1 W	06	28	35	10 NM	01	1022.0	9.4	11.1	5	10	28	8	11.5
LAUREL	H8DE	20	32.0 N	134.5 E	06	08	N 35	5 NM	02	1014.0	25.0	19.5	5	10	06	< 6	10
FRIENDSHIP	ELNP	20	52.9 N	168.3 W	06	33	N 38	5 NM	05	1004.0	6.0	7.0	5	8	24	7	10
VAN TRIUMPH	6ZJP	20	46.5 N	163.5 W	06	27	N 40	5 NM	03	1011.0	7.0	5.0					

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10s	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves? Period sec.	Sea Waves? Height ft.	Swell Waves Dir. 10s	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		MAY															
PRESIDENT ADAMS	KAAV	20	54.4 N	169.0 W	12	34	M 35	10 NM	02	1010.8	5.6	4.4	3	6.5	32	>13	8
SINCERE NO 3	ELRT	21	43.9 N	156.0 W	00	29	M 33	10 NM	15	1015.5	8.0	8.0	8	24.5	30	9	34.5
SEATRAIN TRENTON	9VAJ	21	23.7 N	138.1 E	06	21	M 35	10 NM	02	1009.6	26.5	26.0	4	6.5			
NORSE PILOT	6GVQ	21	31.8 N	144.6 E	14	14	35	2 NM	60	1005.9	20.1	23.0	5	13	14	7	16.5
VAN WARRIOR	5MEV	21	36.6 N	141.4 E	18	01	45	1 NM	63	0991.0	16.0	19.0					
SEALAND PATRIOT	KHRF	21	36.1 N	144.5 E	18	16	M 48	.25 NM	02	0990.0	21.0	18.0	9	13	16	11	13
SINCERE NO 3	ELRT	22	43.8 N	148.8 W	00	32	M 21	10 NM	15	1025.5	12.0	7.0	12	11.5	25	8	24.5
VAN TRIUMPH	6ZJP	22	43.7 N	177.0 W	06	30	M 35	10 NM	02	1006.0	8.0	7.0					
ARCO ALASKA	KSBK	22	38.6 N	124.5 W	06	33	M 35	> 25 NM	00	1015.0	12.8	11.1		6.5	33	6	16.5
PACIFIC SAGA	5MFK	22	34.1 N	155.3 E	18	20	35	5 NM	02	1008.6	21.0	19.0	10	16.5	17	>13	13
SEALAND DEFENDER	KGJB	22	42.5 N	160.6 E	23	18	M 35	1 NM	52	0987.8	13.0	8.0	6	13	18	7	19.5
WORLD HERCULES	JKVA	23	49.8 N	161.0 E	01	09	M 38	.5 NM	25	0987.0	10.8	2.0					
SEALAND DEFENDER	KGJB	23	43.5 N	164.0 E	06	23	M 42	1 NM	10	0994.0	10.4	7.0	6	13	18	7	19.5
MOBILE MERIDIAN	KGSM	23	44.8 N	131.8 W	06	32	M 35	5 NM	21	1024.0	10.0	11.7	8	11.5	31	8	34.5
S P LEE	NDXA	23	38.1 N	123.2 W	06	31	35	10 NM	02	1019.0	10.6	13.3	5	8	31	8	10
PRESIDENT TYLER	WEZM	23	37.4 N	123.2 W	06	33	M 40	10 NM	01	1021.0	11.1	10.6	3	8	31	8	14.5
FRIENDSHIP	ELXP	23	48.1 N	158.1 E	06	33	M 45	.5 NM	60	0974.0	3.0	4.0	8	11.5	32	8	13
PRESIDENT ADAMS	KAAV	23	49.7 N	157.7 E	12	34	45	2 NM	22	0985.4	2.2	1.7	6	23			
KEYSTONE CANYON	KSFK	23	36.7 N	122.5 W	18	32	35	10 NM	02	1016.2	12.2	11.7	2	6.5	32	6	10
VAN TRIUMPH	6ZJP	23	40.9 N	172.5 E	18	27	M 35	10 NM	02	1011.0	12.0	9.0					
VIENNA WOODS	5LOT	23	48.4 N	162.1 E	23	30	M 50	.5 NM	18	0989.0	2.0	1.0	14	49	30	>13	46
DAVID STARR JORDAN	WTDK	23	34.9 N	121.2 W	23	33	M 37	10 NM	02	1016.9	11.2	11.6	3	5	33	6	10
PRESIDENT JEFFERSON	WPGE	24	52.5 N	170.6 E	00	11	35	2 NM	20	0987.2	5.6	2.2	11	3	11	8	13
PRESIDENT ADAMS	KAAV	24	50.4 N	156.4 E	00	35	40	10 NM	02	1005.1	1.1	1.1	8	23			
VIENNA WOODS	5LOT	24	48.1 N	161.2 E	05	31	M 34	2 NM	03	1003.0	4.0	1.0	12	29.5	31	>13	32.5
NOPAL BRANCO	LAHW	24	47.4 N	176.0 W	06	17	M 35	1 NM	64	1004.0	7.0	4.1	3	10	17	10	16.5
SEALAND DEFENDER	KGJB	24	45.8 N	176.1 E	06	24	M 38	2 NM	02	0997.0	6.5	6.0	5	13	20	8	13
SEALAND EXCHANGE	KFOU	24	42.4 N	129.4 W	12	32	35	10 NM	02	1024.0	10.0	12.3	4	8	33	8	10
KEYSTONE CANYON	KSFK	24	40.9 N	126.0 W	18	32	35	10 NM	02	1016.9	12.2	10.0	2	6.5	32	7	13
S P LEE	NDXA	24	40.6 N	127.2 W	18	32	36	10 NM	16	1023.2	11.7	13.4	4	8	32	8	14.5
SEALAND EXPLORER	WGJF	24	40.8 N	173.3 W	18	21	M 35	5 NM	62	1015.3	11.3	11.0	3	5	23	< 6	8
SEA FAN	9VYA	24	46.5 N	172.2 W	23	18	M 29	5 NM	03	0999.7	6.0	7.0	8	24.5	18	7	26
SEALAND DEFENDER	KGJB	25	46.4 N	174.4 W	00	25	M 35	5 NM	02	0994.2	9.0	6.0	6	13	21	8	13
NOPAL BRANCO	LAHW	25	47.2 N	161.5 W	12	18	M 36	.25 NM	47	1010.0	7.5	4.1	2	14.5	17	6	23
SEALAND EXPLORER	WGJF	25	41.1 N	176.3 E	18	29	M 45	5 NM	02	1010.0	9.3	9.0	3	5	28	< 6	19.5
SEALAND EXPLORER	WGJF	26	41.0 N	170.8 E	06	30	M 35	10 NM	02	1016.3	7.5	8.0	3	5	29	< 6	8
PHILADELPHIA	WJEO	26	52.1 N	132.0 W	06	33	35	10 NM	01	1016.9	9.4	12.8	5	8	33	6	13
SEALAND PATRIOT	KHRF	26	25.5 N	121.5 E	06	02	M 38	2 NM	60	1008.3	20.5	22.0	7	8	02	7	8
ARCO ANCHORAGE	WCIO	26	39.1 N	124.9 W	12	33	M 35	10 NM	02	1012.5	10.5	8.8	2	3	33	< 6	5
PRESIDENT MADISON	WCIP	26	50.8 N	132.6 W	18	32	40	10 NM	02	1016.0	8.9	8.9	5	10	32	6	11.5
PERENNIAL ACE	HOMQ	26	49.1 N	129.7 W	21	33	M 36	5 NM	02	1012.0	10.0	10.0	7	8	33	7	10
VAN TRIUMPH	6ZJP	27	38.7 N	150.4 E	00	19	M 40	5 NM	62	1001.0	20.0	18.0					
HANJIN INCHEON	D8OC	27	42.7 N	154.8 E	00	16	25	1 NM	10	1002.0	13.0	10.0	4	6.5	14	9	26
PERENNIAL ACE	HOMQ	27	49.2 N	132.0 W	03	33	M 36	5 NM	02	1013.5	10.0	10.0	6	10	33	7	13
BLESS RIVER	D5BS	27	44.4 N	152.7 E	06	20	M 38	200 YD	46	0990.2	8.5	3.5	9	16.5	15	8	19.5
JUTHLANDIA	ELXV	27	46.2 N	155.0 E	12	23	47	2 NM	02	1000.0	5.0	- 0.2					
CRESSIDA	3FT6	27	49.6 N	165.1 E	18	14	M 40	1 NM	25	1009.0	3.0	0.4	8	13	14	8	14.5
HANJIN INCHEON	D8OC	28	45.8 N	163.9 E	00	27	M 15	1 NM	44	1011.0	8.0	3.0	3	5	14	9	26
MARINER	5LEF	28	53.3 N	147.9 W	01	25	35	5 NM	02	1017.0	10.5	6.0	5	6.5	24	6	8
EASTERN TREASURE	6ZSP	28	36.9 N	174.6 W	06	24	M 35	10 NM	01	1005.0	15.5	12.0	3	14.5	24	7	23
JUTHLANDIA	ELXV	28	41.5 N	148.3 E	18	23	35	5 NM	03	1014.5	9.5	4.4	7	5	23	7	5
TOYOTA MARU 12	JBJO	29	41.6 N	153.0 W	21	16	M 40	1 NM	05	1018.7	16.0	12.5	6	14.5	17	8	16.5
ARCTIC TOKYO	5LJT	30	57.9 N	154.3 W	00	05	M 40	10 NM	03	1021.0	5.0		6	3			
LESLIE LYKES	WHTU	31	42.1 N	159.5 W	06	03	35	10 NM	02	1023.7	7.3	10.6	5	6.5	32	< 6	3
METEOROLOGICAL BUOYS																	
M6004		18	51.0N	136.0W	21	17	M35			1007.9	7.8	7.4	7	11.5			
		JUNE															
PRINCE WILLIAM SOUND	WSDX	1	40.6 N	126.0 W	06	34	M 45	5 NM	02	1017.5	12.5	13.3	8	10	34	12	13
PERENNIAL ACE	HOMQ	1	50.7 N	165.5 E	18	33	M 38	2 NM	02	1010.0	3.5	4.0	5	6.5	30	7	10
MOBILE MERIDIAN	KGSM	1	39.8 N	126.5 W	23	33	M 36	10 NM	02	1022.0	13.3	12.2	8	6.5			
PRINCE WILLIAM SOUND	WSDX	2	46.3 N	131.5 W	06	33	M 40	10 NM	02	1022.4	10.0	12.0	7	8	34	6	11.5
MOBILE MERIDIAN	KGSM	2	37.4 N	123.9 W	12	33	M 38	10 NM	01	1015.2	11.1	11.6	12	14.5			
LESLIE LYKES	WHTU	3	47.9 N	133.6 W	00	33	35	10 NM	15	1017.5	9.4	8.8	5	5	34	8	8
CRYSTAL STAR	D5TG	7	46.8 N	168.3 E	12	26	M 40	200 YD	47	1003.0	6.0	3.0	3	10	27	10	21
PERENNIAL ACE	HOMQ	9	42.9 N	165.7 E	12	20	M 35	.25 NM	53	1012.5	7.0	6.5					
SEALAND DEFENDER	KGJB	9	36.5 N	146.3 E	18	20	M 35	10 NM	02	1010.5	22.5	21.0	5	13	20	< 6	13
DIAMOND PHOENIX	D5MS	10	35.7 N	124.2 W	00	34	M 40	5 NM	02	1015.5	15.0	15.5	4	5	33	< 6	6.5
MING SPRING	BLMR	10	50.3 N	171.5 W	00	27	M 40	2 NM	64	0992.5	6.5	3.0	7	19.5			
ARCTIC TOKYO	5LJT	10	36.9 N	143.8 E	18	18	M 36	1 NM	81	1005.0	21.0	2.2	9	3			
SEATRAIN PRINCETON	DMPV	11	39.9 N	157.9 E	18	22	39	2 NM	60	0995.3	14.4	14.5	9	11.5	19	6	8
MANJIN POHANG	D8ON	12	46.4 N	157.6 E	00	08	M 35	2 NM	47	1003.5	5.0	6.0	5	8	08	6	8
PACIFIC SAGA	5MFK	12	49.9 N	154.4 W	06	21	35	2 NM	41	1015.5	8.0	6.0	8	19.5	XX		8
ARCTIC TOKYO	5LJT	12	43.3 N	155.6 E	06	35	M 40	2 NM	88	0995.0	8.0	9.0	9	3			
SIMBA	OWEC	12	51.9 N	152.7 W	12	24	M 35	1 NM	52	1010.9	9.1	13.5	8	8	19	9	16.5
AUSTRAL RAINBOW	WEZP	13	32.6 N	120.0 W	00	20	M 35	10 NM	00	1019.3	13.9	12.2	1	6.5	30	9	8
BELLMAN	9VUP	13	42.1 N	158.3 E	06	27	M 48	10 NM	02	1003.5	10.0	9.0	4	10	29	11	13
SACRAMENTO	H3OR	15	49.5 N	167.6 E	12	27	M 40	5 NM	41	1007.0	5.0	3.0	8	13	26	8	13
HANJIN INCHEON	D8OC	15	50.6 N	167.7 W	21	27	M 25	5 NM	02	1010.0	9.0	6.0	4	6.5	29	10	29.5
ARCTIC TOKYO	5LJT	16	54.3 N	165.2 W	00	09	M 40	10 NM	03	1010.0	7.0	3.0	4	1.5			
MEONIA	OXON	16	30.5 N	116.7 W	18	33	M 35	5 NM	05	1015.5	17.0	18.0	6	8			
HOEGH MERIT	LEVB	16	38.7 N	124.1 W	18	32	M 40	10 NM	01	1016.5	14.5	13.8			32	8	11.5
HOEGH MERIT	LEVB	17	41.4 N	125.0 W	06	01	M 35	> 25 NM	02	1020.0	13.0	14.0	8	11.5			
ORIENTAL STATESMAN	ELPE	17	35.2 N	141.0 E	12	23	M 35	5 NM	03	0999.2	25.2	23.0					
CLOVER	A8GP	17	34.9 N	140.7 E	18	20	M 36	1 NM	02	0996.7	24.0	28.0	6	14.5	20	6	14.5
EASTERN DIAMOND	HOOT	18	51.9 N	174.5 E	00	24	M 35	5 NM	03	1007.0	8.0	5.0	6	6.5	26	6	10
PRESIDENT PIERCE	WURV	18	32.3 N	135.9 E	06	23	50	2 NM	50	1002.0	26.7	24.4	6	11.5	23	10	16
GREEN KOBE	JNRY	18	54.4 N	165.7 W	09	17	M 36	5 NM	48	1017.9	8.0	7.0	5	19.5	18	6	23
AMERICA SUN	WNEJ	18	19.7 N	106.5 W	18	12	M 36	10 NM	01	1011.5	29.4	28.1	4	8	13	8	10
DIAMOND PHOENIX	D5MS	18	38.7 N	163.3 E	18	27	M 38	5 NM	05	0996.0	19.0	20.0	6	6.5	27	6	10
S T ALASKA	WFQE	18	19.8 N	106.1 W	21	13	35	10 NM	02	1008.5	28.9	28.9	6	6.5			
EASTERN DIAMOND	HOOT	19	49.6 N	166.8 E	06	18	M 35	2 NM	41	0986.0	8.0	4.0	6	8	18	< 6	10
PRESIDENT TRUMAN	WLPL	19	47.0 N	173.2 E	12	19	35	200 YD	44	1005.0	7.7	4.5	4	8	23	10	13
PACIFIC VENTURE	HOVS	19	47.9 N	171.1 E	12	22	M 35	.25 NM	45	0998.3	8.0	5.0	10	16	22	10	19.5
GREEN KOBE	JNRY	19	53.1 N	177.5 W	15	25	M 36	2 NM	63	0996.0	9.5	6.0	4	10	25	6	19.5
SINCERE NO 3	ELRT	19	53.4 N	178.1 E	18	22	M 35	.25 NM	45	0993.0	5.8	4.0	6	18	22	6	24.5

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C		Sea Waves†			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10s	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10s	Period sec.	Height ft.	
NORTH PACIFIC OCEAN		JUNE																
EASTERN DIAMOND	MUDI	20	47.2 N	160.0 E	00	26	M 35	5 NM	03	1009.0	7.0	5.0	5	10	26	>13	10	
UNITED SPIRIT	SMKM	20	50.7 N	175.5 W	00	21	M 40	200 YD	49	1010.3	12.0	7.0	15	14.5	21	7	14.5	
SINCERE NO 3	ELPI	20	53.2 N	174.7 E	06	27	M 30	.5 NM	41	0999.0	6.0	5.0	5	24.5	24	7	24.5	
S P LEE	NGYA	20	58.2 N	151.9 W	06	18	35	5 NM	03	1016.0	8.9	8.3	3	8				
GLACIER BAY	WACF	21	35.7 N	122.1 W	00	32	48	10 NM	01	1017.5	15.0	11.7	3	11.5	32	< 6	10.5	
SINCERE NO 5	ELPI	21	51.6 N	167.5 E	06	24	M 30	5 NM	01	1000.5	5.5	5.0	6	19.5	23	6	29.5	
THOMAS G THOMPSON	WGWT	23	51.1 N	145.6 W	12	29	M 40	2 NM	07	1001.8	8.9	7.8	6	8	29	8	16	
PRESIDENT MADISON	WCTP	24	52.2 N	139.1 W	06	33	35	10 NM	01	1010.0	10.0	7.8	6	6.5	26	6	8	
BLESS RIVER	DSPS	24	44.8 N	138.3 W	06	30	M 36	5 NM	03	1011.2	12.0	12.0	5	8	30	6	16	
PRESIDENT TYLER	WEZM	24	46.7 N	164.9 W	12	21	M 45	.5 NM	18	1001.1	10.0	6.1						
PRESIDENT TYLER	WEZM	25	46.2 N	159.2 W	00	20	M 35	.5 NM	44	1018.5	10.6	6.7	8	13	20	6	26	
EXXON NORTH SLOPE	KHLG	25	17.0 N	101.7 W	18	12	45	10 NM	19	1012.8	28.4	26.1	3	10	12	6	16.5	
SURVEYOR	WTES	26	54.3 N	164.1 W	00	28	M 37	10 NM	02	1016.5	7.2	7.2	3	8	32	< 6	8	
EXXON PHILADELPHIA	WNFJ	28	39.3 N	124.5 W	03	35	M 42	10 NM	03	1016.4	16.8	14.4	5	19.5	32	6	13	
MARINER	SLFF	29	45.2 N	153.8 E	02	05	40	1 NM	62	1004.0	10.0	6.0	5	13	06	10	14.5	
PRESIDENT GRANT	WEZD	29	41.6 N	150.2 E	12	33	M 38	2 NM	02	1000.3	6.8	10.0	3	8	05	< 6	13	
SEALAND MCLEAN	WNGA	29	38.8 N	150.9 E	12	31	35	10 NM	02	1003.0	17.5	17.2	6	10	31	8	10	
PRESIDENT MADISON	WCTP	29	45.6 N	156.4 E	12	05	35	5 NM	05	1002.0	6.8	4.5	7	11.5	05	7	11.5	
LNG LEO	WLTB	29	21.9 N	124.1 W	18	07	M 35	> 25 NM	18	0996.5	28.0	28.4	2	3	06	8	5	
EXXON PHILADELPHIA	WNFJ	30	41.0 N	125.5 W	00	36	M 35	10 NM	01	1014.2	17.0	16.7	3	5	36	7	13	
FRIENDSHIP	ELXP	30	36.0 N	142.6 E	00	05	M 42	1 NM	61	1000.8	20.0	20.0	5	6.5	05	8	6.5	
MARINER	SLEF	30	46.8 N	159.3 E	02	05	40	200 YD	47	1005.4	8.0	5.0	6	10	05	7	14.5	

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

U.S. Cooperative Ship Weather Reports

May and June 1980

This listing includes only those ships recruited in the U.S. Cooperative Ship Program whose Ship's Weather Observations (NOAA Form 72-1) were mailed to the National Climatic Center and/or the coded weather observations were transmitted to the appropriate radio station.

SHIP NAME	VIA RADIO	VIA MAIL
OGDEN THAMES	18	27
ACUSHNET WAGO 167		74
ADRTATIK	20	
ALASKA STANDARD	29	41
ALERT	9	
ALLTRANS ENTERPRISE	3	
ALVA MAERSK	30	78
AMERICAN ACCORD	41	119
AMERICAN AQUARIUS	27	127
AMERICAN ASTRONAUT	37	101
AMERICAN CORSAIR	7	
AMERICAN HIGHWAY	24	
AMERICAN LEADER	38	103
AMERICAN LIBERTY	23	88
AMERICAN RELIANCE	14	11
AMOCO CHALLENGER	11	
ANCO TEMPLAR	97	
ANNIE JOHNSON	4	49
APCO ANCHORAGE	19	69
ARCO JUNEAU	31	
ARCTIC TOKYO		150
ARNOLD MAERSK	23	50
ASHLEY LYKES	13	55
ASIA HERON	7	10
ASIA HOMO	3	
ATHELREGENT	1	
AUSTRAL ENDURANCE	32	82
AUSTRAL LIGHTNING	62	106
AUSTRAL PIONEER	22	103
AXEL MAERSK	7	25
BALC BUTTE	4	20
BARBER TOBA	15	12
BAY	22	48
BFL HUDSON	1	
BLUE BOTTLE	6	23
BOGASARI SATU	22	22
BRIGHT HOPE	31	16
BUILDER	6	25
C V STACHOUND	22	71
CALIFORNIA RAINBOW	13	15
CARIBBEAN ENDEAVOUR	1	
CHANCELLORSVILLE	6	76
CHARLOTTE LYKES	50	110
CHANEZ	44	161
CHESNUT MILL	41	57
CHEVRON SURNARY	41	123
CHEVRON FELUY	1	71
CHEVRON LONDON		157
CHEVRON OREGON	6	
CHEVRON WASHINGTON	29	19
CITRUS WAGO20	36	
COLIMBIA	1	
COMFT	14	34
CORNUCOPIA	28	115
CRESSIDA	29	77
CUNARD AMBASSADOR	1	
CANA AMERICA	7	
DAVID P REYNOLDS	108	168
DE STEIGUER T-AGOR12	11	
DELAWARE GETTY	33	99
DELTA AMERICA	8	62
DELTA COLUMBIA	23	17
DELTA SUD	11	36
DIAMOND PHOENIX	34	102
DITTE SKOU	13	79
DOLLY TURMAN	10	
DRUCILLA W		25
DYNT PACIFIC		6
EASTERN DIAMOND		139
EASTERN RIVER	21	40
EDGAR M QUEENY	45	38
ENNE G	11	31
ESSO PROVIDENCE	34	45
EVER SPRING	24	54
EXPORT AMBASSADOR	26	53
EXPORT CHAMPION	23	92
EXPORT PATRIOT	25	64
EXXON BOSTON	20	36
EXXON HOUSTON	19	39
EXXON NEW ORLEANS	15	22
EXXON SAN FRANCISCO	47	72
FALSTRIA	36	109
FLEETBANK	20	
FRIENDSHIP	27	115
GARDENIA	24	30
GENISTA	5	41
GLACIER BAY	33	121
GLOMAP CHALLENGER	129	195
GOLDEN ORCHID	2	4
GRAND GLOBE	17	11
GREEN FOREVER	93	108
GREEN KOBE	6	90
GULF BANKER	16	55
GULFCREST	1	
HANJIN POMANG		40
HAWAIIAN CITIZEN	96	176
HILLTER WROWN	18	38
HOEGH MERIT	11	32
HOEGH PILOT	4	40
HOFANA MARU	91	47
HUMACAO	45	
IRIS ISLAND	24	97
ITAPUCA	1	
JACKSONVILLE	16	99
JAMES LYKES	7	54
JAPAN CAOBO	7	111
JELA TOPIC	11	70
JUTHLANDIA	11	87
KENNETH E HILL	26	101
KNORR	65	95
KOREAN COMMANDER	4	
KUROBE MARU	45	26
LAKE BERRYESSA	6	6
LASH ITALIA	1	69
LEO	8	18
LILLDOLT	8	59
LONG BEACH		43
LURLINE	51	111
MALLON-WLB 396	2	
MANISTEE	17	
MANULEI	75	103
MARCONA TRADER	18	26
MARGARET JOHNSON	47	26
MARIAS TAO-57		20
MARITIME DOMINION	11	
ACADIA	5	
ADABELLE LYKES	26	
AFRICAN DAWN	20	93
ALASKAN	19	44
ALEUTIAN DEVELOPER	36	49
ALTRANS EXPRESS	24	69
AMELIA TOPIC	1	37
AMERICAN ACE	4	108
AMERICAN ARCHER	90	133
AMERICAN CHALLENGER	13	64
AMERICAN COURIER	11	
AMERICAN INDEPENDENCE	23	132
AMERICAN LEGACY	59	102
AMERICAN LYRX	85	127
AMERICAN TRADER	56	213
AMOCO MILFORD HAVEN	13	19
ANDALUSIA	7	
ANTE TOPIC	42	40
ARCO ENTERPRISE	16	34
ARCO PRESTIGE	24	87
ARECIBO	66	102
ARTHUR MAERSK	45	130
ASIA BEAUTY	9	17
ASIA HONESTY	9	90
ASIAN ASSURANCE	1	94
ATLANTIC BEAR	1	
AUSTRAL ENSIGN	40	63
AUSTRAL MOON	57	55
AUSTRAL RAINBOW	79	147
AZTECA	18	36
BALTIMORE TRADER	8	27
BARBER TOWSBERG	15	
BAYAMON	7	110
BELLMAN	41	96
BLUE OCEAN	14	73
BOHEME	53	84
BRINTON LYKES	15	28
BURGA HELMUTS	32	70
C.W. KITTO		57
CAMPBELL WHEC 32	1	
CARNIVALE	31	30
CHAPMAN	23	27
CHASE WHEC 718	6	12
CHEMICAL VENTURE	25	
CHEVRON ANTWERP	9	
CHEVRON CALIFORNIA	73	70
CHEVRON FRANKFURT	9	
CHEVRON LOUISIANA	1	
CHEVRON PENNIS	35	95
CHIBA	1	
CIUDAD DE NEIVA		23
COLUMBUS AMERICA	17	18
CONCORDIA STAR	18	
CORVIGLIA	2	
CRISTOBAL	27	74
DAFFODIL	18	38
DANWOOD ICE	52	125
DAVID PACKARD		125
DEFIANCE	27	68
DELAWARE II	143	154
DELTA ARGENTINA	12	22
DELTA ECUADOR	49	98
DELTA URUGUAY	14	29
DIANA	21	
DJATISARI	5	
DONA CORAZON II		93
DUBHE	14	
E. HORNSBY WASSON	17	57
EASTERN FORTUNE	24	34
EASTERN TREASURE	31	128
EL MEXICANO	10	
ERNA OLDENDORFF	15	
ESSO SAINT JOHN	5	
EVEF VALUE	6	26
EXPORT BANNER	19	69
EXPORT COURTIER		7
EXXON BALTIMORE	20	35
EXXON CHESTER	16	27
EXXON HUNTINGTON	12	21
EXXON NEWARK	5	6
EXXON WASHINGTON	22	35
FEDERAL SUMIDA	6	
FRANCIS SINCERE NO 6	25	24
GAGE LUND	60	
GARTHSEAYOR	25	54
GEORGE W KELEZ	11	
GLADIOLUS	16	13
GOLDEN DAISY	19	
GOLDEN RAY	11	
GREAT LAND	49	46
GREEN FOWARD	22	
GREEN LAKE	1	
GULF MERCHANT	19	60
HAQJI ASUS SALIM	16	
HARJIA SEJOL	2	7
HELLESPORT GLORY	19	14
HOEGH CLIPPER	6	
HOEGH MIRANDA	6	39
HOEGH TRAVELLER	1	
HOWARD G VESPER	17	69
IMPERIAL	17	
IRIS QUEEN	85	
J E GOSLINE	5	59
JAGORA	1	
JAPAN ACE	96	40
JAPAN RAINBOW	7	67
JOHN LYKES	34	9
KASHU MARU	87	46
KENTUCKY HOME	2	
KOBE STAR	29	38
KOREAN PIR	17	6
LAM. FUNKHOUSER	13	109
LAKE PALGURDE	9	
LASH PACIFICO	17	71
LESLIE LYKES	28	51
LIONS GATE BRIDGE	114	97
LOUISE	58	130
LUTZ SCHROEDER	9	
MAMMOTH PIR	15	84
MANUAWILI	41	37
MANZANARES	9	
MARCONA TRANSPORTER	41	124
MARGARET LYKES	19	
MARINE CHEMICAL TRANSP	17	38
MARITIME HARMONY	1	2
ACE ENTERPRISE	20	98
ADM ARA M CALLAGHAN	35	97
AGUADILLA	84	134
ALBATROSS IV	32	
ALGENIB	147	155
ALMERIA LYKES	27	147
AMERICA MARU	63	32
AMERICAN ALLIANCE	26	109
AMERICAN ARGOSY	37	42
AMERICAN CHARGER	2	82
AMERICAN EXPLORER	24	56
AMERICAN LANCER	39	136
AMERICAN LEGEND	49	121
AMERICAN RACER	17	66
AMERICANA	17	49
ANCHORAGE	39	91
ANDERS MAERSK	38	73
AQUARIUS	29	47
ARCO FAIRBANKS	55	92
ARCO PRUDHOE BAY	47	80
ARGONAUT	26	67
ARTHUR MIDDLETON	7	
ASIA BOTAN	21	78
ASIA HUNTER	4	
ASIAN EXPRESS	6	
ATLANTIC PIONEER	5	
AUSTRAL ENTENTE	69	51
AUSTRAL PATRIOT	5	48
AVILA	9	25
B T ALASKA		58
BARBER PRIAM	29	
BARRANCA	84	104
BAYAMO	59	27
BERKES	34	
BLUEBIRD	85	68
BORINQUEN	93	115
BRITANIS	4	
BUTTONWOOD WLB 306	6	
CADOGAN	1	
CANADIAN PEEFER	1	
CARNIVAL	15	
CHARLES LYKES	40	111
CHASTINE MAERSK	21	56
CHEROKEE WHEC 165		5
CHEVRON ARIZONA	71	105
CHEVRON COLORADO	50	68
CHEVRON GENOA	1	
CHEVRON MISSISSIPPI	17	55
CHEVRON PERTH	35	91
CHIRO	6	26
CLARA MAERSK	7	
COLUMBUS LOUISANA	24	94
CONSOLICATED VENTURE	1	
COURAGEOUS WHEC 622		102
CORAL REEF	39	28
DALAMAR	33	45
DAUNTLESS CG	9	
DAVID STARR JORDAN	27	36
DEL RIO	9	
DELAWARE SUN	9	
DELTA BRASIL	19	47
DELTA MAR	21	114
DELTA VENEZUELA	5	17
DILIGENCE WHEC 616		65
DOCEANGRA	5	
DONA MAGDALENA		108
DURABLE	1	
EAGLE	80	
EASTERN MUSE	34	
EASTERN WISEMAN	14	
ELIZABETH LYKES	24	32
ESSO CASTELLON	10	
ESSO TORONTO	1	
EVERGREEN WAGO-295	102	78
EXPORT BUYER	23	31
EXPORT FREEDOM	11	37
EXXON BANGOR	26	43
EXXON FLORENCE	4	9
EXXON LEXINGTON	13	69
EXXON NORTH SLOPE	1	42
FAIRLOAD	1	
FESTIVALE	44	78
FREDERICK LYKES	10	26
GALLATIN WHEC 721		9
GENE TREFETHEN	48	
GEORGE M KELLER	4	139
GLOBAL FRONTIER	38	91
GOLDEN GATE	14	57
GOLDEN ROD	26	
GREEN GALLAN	14	
GREEN HARBOUR	6	44
GREEN VALLEY	14	68
GULF SKIPPER	34	68
HAMILTON WHEC 715	1	
HARDANGER	2	9
HERON	23	
HOEGH MARLIN	13	
HOEGH OPAL	8	
HONSING BREEZE	16	23
HOWELL LYKES	39	99
INACHUS STAR	33	85
IRONWOOD WLB 297	10	
J LOUIS	59	90
JALAPATANI	11	
JAPAN AMBROSE	47	43
JEAN LYKES	4	19
JOHN TYLER	9	
KATHY	5	
KEYSTONER	68	146
KOFUKU MARU	26	118
KOREA LEADER	12	16
LABRADOR CLIPPER	32	
LAKE SHASTA	15	58
LAVAUR	6	
LETITIA LYKES	18	32
LIPSCOMB LYKES	3	21
LOUISE LYKES	7	41
MAGDALENA	99	
MANHATTAN	35	99
MANUAI	82	139
MARCONA CONVEYOR	47	78
MARCONA VENTURER	1	
MARIA RUBICON	2	
MARIT MAERSK	1	
MARITIME QUEEN		27
ACONCAGUA	6	11
ADRIAN MAERSK	48	91
AIMEE LYKES	24	99
ALBERT MAERSK	24	60
ALLISON LYKES	11	6
ALSTER EXPRESS	46	51
AMERICA SUN	47	142
AMERICAN APOLLO	25	128
AMERICAN ARROW	18	
AMERICAN CHIEFTAIN	55	70
AMERICAN HERITAGE	6	
AMERICAN LARK	35	108
AMERICAN LEGION	29	119
AMERICAN RANGER	19	51
AMOCO CAIRO	1	
AMOCO SIANE	157	
ANNA MAERSK	22	79
ARCO ALASKA	27	63
ARCO HERITAGE	26	29
ARCO SAG RIVER	17	24
ARILD MAERSK	29	75
ARYA MAN	1	
ASIA BREWERY	16	127
ASIA INDUSTRY	3	
ATHEL LAADKI	3	
ATLANTIC RAINBOW	34	103
AUSTRAL ENVOY	43	92
AUSTRAL PILOT	14	
AXEL JOHNSON	14	32
B T SAN DIEGO	25	202
BARBER TAIF	21	22
BARTLETT AGOR 13	34	36
BEISHU MARU	93	44
BLESS RIVER	15	65
BOGASARI DUA	1	
BOSTON	5	9
BROOKS RANGE	22	28
C V LIGHTNING	14	20
CAGUAS	1	19
CAPRICORN	51	73
CHALMETTE	46	22
CHARLES PIGOTT	57	209
CHAUVENET T AGS 29	38	98
CHESHIRE		94
CHEVRON BRUSSELS		99
CHEVRON EDINBURGH	4	
CHEVRON HAWAII	1	
CHEVRON NORTH AMERICA		116
CHEVRON SOUTH AMERICA		156
CHRISTOPHER LYKES	17	13
COLORADO	43	107
COLUMBUS VICTORIA	38	78
CORAL ARCADIA	6	
COVADONGA	5	106
CRYSTAL STAR	22	63
DALLAS WHEC 716	1	102
DAVID D. IRWIN	54	68
DAVIDSON	11	16
DEL SOL	12	52
DELTA AFRICA		72
DELTA CARIBE	3	
DELTA MEXICO	7	26
DEPENDABLE WHEC 626		91
DISCOVERER OSS	119	136
DOCTOR LYKES	29	120
DORIC	28	78
DYNT KATTEGAT	1	14
EASTERN CHERRY	63	99
EASTERN PACIFIC	4	8
EASTERN WORLD	28	
EMPIRE STATE	21	16
ESSO PALM BEACH	5	9
EURO-ASIA CONCORDE	34	71
EXFORD	1	
EXPORT CHALLENGER	7	28
EXPORT LEADER	5	40
EXXON BATON ROUGE	40	80
EXXON GETTYSBURG	4	3
EXXON PHILADELPHIA	24	54
FAIRWEATHER	15	30
FIREBUSH WLB 393	6	7
FREEDOM	12	17
GALLEON OPAL	1	
GENEVIEVE LYKES	22	16
GIBRALTAR MARU	11	32
GLOBAL WING	21	31
GOLDEN GATE BRIDGE	25	
GRACE	124	63
GREEN AUKLET	4	
GREEN ISLAND	48	
GRETE MAERSK	7	
GULF TRADER	9	
HANJIN INCHEON	49	99
HARUNA MARU	8	29
HIEI MARU	116	95
HOEGH MERCHANT	136	92
HOEGH ORRIS		35
HONSHU GLORIA	32	61
HUDSON T-AO 184	31	
INGER	22	2
ITALICA	2	28
J R GREY	12	
JAMES E O'BRIEN		7
JAPAN APOLLO	1	
JEFF DAVIS	34	29
JOSEPH LYKES	4	
KEIYO	18	17
KEYTRADER	23	124
KOPAA	1	
KOREAN PRIDE	72	134
LAKE ALMANOR	18	29
LASH ATLANTICO	7	46
LEDA MAERSK	42	62
LEXA MAERSK	7	23
LIVERPOOL CLIPPER	44	
LUIGI GRIMALDI	1	
MALLORY LYKES	25	95
MANICA	6	72
MANULANI	10	
MARCONA EXPORTER	72	101
MARDI GRAS	20	105
MARIA U	46	49
MARITIME BRILLIANCE	23	37
MARJORIE LYKES	7	
	18	24

TOTAL WEATHER REPORTS RECEIVED FROM US COOPERATIVE OBSERVING SHIPS MAY AND JUNE 1980

SHIP NAME	VIA RADIO	VIA MAIL
MATHIESON	20	13
MAYAGUEZ	33	105
MENESTHEUS	31	12
MIDDETT WMEC 726	54	70
MINERVA	4	
MING SPRING	19	27
MOBIL LUBE	8	
MOBILGAS	7	
MORANT	24	
MORMACGLEN	7	61
MORMACSEA	9	62
MORMACSEGA	21	50
MT MITCHELL	66	141
NAVASOTA		27
NEPTUNE RUBY	3	
NEWARK	62	119
NOPAL LANE	6	
NORTH STAR III	2	6
NOWIA	1	
OCEAN ENERGY CONVENTER	8	27
OGDEN CONGO		67
OJI VALERIA	27	21
ORANGE	125	
ORE SATURN	3	8
ORIENTAL ESEARCHER	5	4
ORIENTAL IMPORTER	13	
ORIENTAL SOVEREIGN	30	
OVERSEAS ALEUTIAN	17	47
OVERSEAS NEW YORK	1	3
PACFUCHSIA	15	8
PACIFIC ARROW	36	32
PACIFIC SAGA	67	140
PACIFIC WING	1	
PACMERCHANT	20	58
PACPRINCESS	13	
PAN WESTERN	23	14
PAUL L FAHRNEY		51
PHILADELPHIA	58	102
PIONEER COMMANDER	14	23
PIONEER MOON	45	78
PRESIDENT CLEVELAND	17	35
PRESIDENT HOOVER	62	122
PRESIDENT KENNEDY	65	136
PRESIDENT POLK	46	79
PRESIDENT TYLER	60	131
PRINCE WILLIAM SOUND	20	61
QUEENS WAY BRIDGE	99	60
RALPH J JOHNSON	7	60
RESEARCHER	65	103
RHEINFELS	13	
RIO COBRE	1	
ROBERTSMARK	9	25
ROYAL VIKING SKY	44	25
SACRAMENTO	2	76
SAMOA	42	30
SANKOSTAR	22	29
SANTA CLARA	11	
SANTA MERCEDES	41	103
SEA FAN	9	14
SEALAND ECONOMY	67	101
SEALAND LEADER	28	67
SEALAND PRODUCER	24	111
SEALIFT CARIBBEAN	1	
SEATRAIN ORISKANY	38	163
SEAWAY	42	42
SEVEN OCEAN	15	
SHUHSAND	40	98
SILVER PHOENIX	22	36
SINCERE NO 3	19	46
SKYBARD	14	
SNOWFLOWER	2	7
SOLON TURMAN	24	
SPIRIT OF LIBERTY	9	20
STAR POWER	26	58
STOLT LLANDAFF	12	83
STREAM MAWSER	19	24
SURVEYOR	78	109
T F L INDEPENDENCE	21	56
TALUGA T-AG-62		7
TAURUS	50	149
TEXAS	11	10
THOMAS C THOMPSON	101	122
THOMPSON PASS	26	35
TOKYO RAINBOW	14	
TOWNSEND CROMWELL	117	163
TOYOTA MARU 1	66	38
TROIN MAERSK	2	1
TUBUL	7	17
UNION CONCORD	12	
UNIVERSE	20	58
VAN CONQUEROR	47	96
VELMA LYKES	10	97
VIGOROUS WMEC-627		26
WANDLPER	1	
WESTERN HIGHWAY	30	44
WHITING	3	
WINTER WATER	2	15
WORLD PELAGIC	1	
YOCONA WMEC 166	34	
ZAPATA COURIER	30	
ATOR	4	28
BPDR	27	59
CKBS	23	69
DSN7	23	47
DSYP	4	6
ELIJ	25	29
EWN		16
HJVC		41
ICKL	9	73
JJIE	32	27
JNBY	7	67
KDNA		26
KHMP	42	131
KSFJ	38	66
LDHU		32
NHDS	24	20
NMQ7	28	31
SNAC	38	142
VRCF	27	33
WEXU		20
ZFCB	33	40
3FW5	3	32
9LAT		14
9MSW	11	12
9MTP	42	101
9WVT	64	146
MATSONIA	29	48
MAYO LYKES	11	
MEONIA	55	122
MILEA		14
MING AUTUMN	24	26
MING YOUNG	59	60
MOBIL POWER	15	91
MONMOUTH	29	49
MORMACALTAIR	16	72
MORMACLYNX	38	95
MORMACSKY	19	40
MORMACWAVE	7	
MUNRO WMEC 724	4	
NECHES	31	59
NEW GOLDEN PHOENIX	65	86
NEWCASTLE CLIPPER	69	
NOPAL VERDE	5	13
NORTHERN LIGHT		7
NURA DEL MAR	9	9
OCEAN LOG	31	29
OGDEN FRASER	21	6
OLEANDER	80	93
ORCC MINER	9	
OREGON II	1	
ORIENTAL ESPERALDA	1	
ORIENTAL LADY	1	
ORIENTAL STATESMAN	21	67
OVERSEAS ARCTIC	13	36
OVERSEAS VALDEZ		14
PACEMPEROR	16	
PACIFIC ERA	70	165
PACIFIC TELSTAR	1	
PACKING	6	2
PACMOBARCH	9	
PACSTAR	7	12
PARALLA	17	45
PEREIRA D'ECA	16	
PHILIPPINE ANTONIO LUN	1	55
PIONEER CONTENDER	20	79
POLAR STAR WAGB-10	167	87
PRESIDENT FILLMORE	52	127
PRESIDENT JACKSON	38	31
PRESIDENT MACISON	44	124
PRESIDENT TAFT	39	127
PRESIDENT VAN BUREN	57	124
PROSPERITY	21	
QUINTINA	32	
REG ARROW	27	35
RESOLUTE	29	80
RICHARD	37	44
RIO OLIVIA	16	20
RODRIGUES CABRILHO	29	17
ROYAL VIKING STAR	21	24
SALVADOR	18	44
SAMUEL S	7	
SANKOSUN	17	
SANTA MAGDALENA	35	30
SANTO AMARO	9	
SEALAND ADVENTURER	20	68
SEALAND EXCHANGE	77	125
SEALAND MARKET	14	41
SEALAND RESOURCE	84	111
SEASPEED ASIA	1	26
SEATRAIN PATNCETON	79	162
SEDGE WLB 402	7	
SHANGRI LA	59	
SIENA	21	41
SILVER STAR	14	21
SINCERE NO 6	16	
SNOW FALL	1	
SNOWLAND	1	
SOUTHWARD	26	67
SPRUCE	23	
STAR HONGKONG	45	45
STONEWALL JACKSON	9	24
STUYVESANT	79	72
SUSQUEHANNA	11	122
TAI HSING	18	41
TAMPA	30	27
TERRIER	17	50
TEXAS CLIPPER	47	
THOMAS MAERSK	9	
TILLIE LYKES	49	148
TOKAMI MARU	130	49
TOYOTA MARU 10	113	72
TOYOTA NO 28	47	32
TRIUMPH	42	
TWIN JOY	10	
UNICUE FORTUNE	14	
UNIVERSE KURE	7	114
VAN TRIUMPH	54	57
VENTUROUS WMEC 625	24	
VIOLET	43	39
WASHINGTON WOOL	7	
WESTERN SUN	20	57
WILLIAM E MUSSMAN		44
WINTER WAVE	12	60
WORTH	14	
YOUNG AMERICA	29	89
ZIM MONTREAL	10	5
ABUJ	23	61
ADGP		119
CZDB		119
DSEP	9	19
DSGE		47
DSOE		47
DSOR	2	17
EBOR	10	18
ELDO	19	28
GWOE	19	28
HBAY	8	6
HJAV	19	36
JCNI	7	10
JAIO		201
JPAY		10
KFGY		22
KIBN		44
KSFN	13	35
KUWN	9	44
LEVN		6
NLGA		62
NVUW		29
S6CT	14	29
VOCH	24	52
WBUF	24	93
3EJX	8	16
3FYP	47	49
9LOY	11	15
9MUE	11	62
9MUT	47	87
MAUI	70	138
MEADOWBROOK	17	83
MERCY	11	5
MILLER FREEMAN	15	13
MING CHEER	39	22
MOBIL AERO	19	43
MOBILE MERIDIAN	46	119
MONTERREY	5	26
MORMACARGO	16	68
MORMACRIGEL	8	37
MORMACSTAR	8	24
MORNING GLORY	52	48
NAGARA	18	
NEPTUNE CRYSTAL	64	112
NEW JERSEY MARU	78	18
NORAWAY	39	106
NORDIC LOUISIANA	49	
NORTHWIND WAGB 282	35	
OCEAN CROWN	5	25
OCEANIC	123	174
OGDEN THAMES	38	89
OLGA MAERSK		78
ORE JUPITER	32	39
ORIENTAL CHAMPION	24	38
ORIENTAL EXECUTIVE	23	54
ORIENTAL LEADER	16	
ORIENTAL TATO		23
OVERSEAS CHICAGO	12	41
PACPARON	16	9
PACGLORY	17	9
PACIFIC GLORY	7	
PACIFIC TRADER	57	
PACLADY	7	18
PACNOBLE	5	
PAN ASIA	4	43
PASSUMPSIC AG-187		81
PERENNIAL ACE	87	152
PHOSPHORE CONVEYOR	1	
PIONEER CONTRACTOR	28	80
PORTLAND	55	67
PRESIDENT GRANT	65	137
PRESIDENT JEFFERSON	52	108
PRESIDENT MC KINLEY	68	149
PRESIDENT TAYLOR	16	
PRESIDENT WILSON	13	69
PROSPERITY QUEEN	28	54
QUIXADA	48	23
REGINA CELI	4	
RESOLUTE WPC 620	31	39
RIGOLETTO	5	7
RIO ORINOCO	1	
ROSE		55
RUTH LYKES	36	130
SAM HOUSTON	6	
SAN FRANCISCO	60	83
SANSINENA II	28	65
SANTA MARIA	21	54
SARGODHA	32	32
SEALAND COMMERCE	54	111
SEALAND FINANCE	80	125
SEALAND MCLEAN	35	109
SEALAND TRADE	56	140
SEATRAIN INDEPENDENCE	66	109
SEATRAIN TRENTON	66	153
SEPTA	1	
SHELDON LYKES	12	37
SILVANA	2	
SILVERLINE		16
SINCLAIR TEXAS		11
SNOW STORM	11	57
SOCONY VACUUM	7	54
SOUTHWEST CAPE	40	12
STADT AMEMEN	6	
STARWARD	8	
STOPIS WAGB 38	2	41
SUCCESSFUL VENTURE	29	18
SVENDORG MAERSK	15	34
TAIKO VENTURE	3	
TANEY WMEC 37	2	
TEXACO MASSICHUSETTS		7
TEXAS TRADER	16	56
THOMAS NELSON	18	69
TOBIAS MAERSK	7	
TONCE TOPIC	2	
TOYOTA MARU 12	171	102
TRANSCOLORADO	3	
TROPICANA	5	
TYSON LYKES	15	39
UNITED SEA ANGEL	12	7
VALLEY FORGE	59	98
VAN WARRIOR	53	133
VICENTE GUERRERO	7	
WALCHAND	17	
WECOMA	91	192
WESTWARD VENTURE	68	93
WILMINGTON GETTY	73	122
WORLD CANDOUR	19	39
YAMASHIN MARU	92	81
YOUNG SEAGULL	9	71
ZIM TOKYO	12	
ABUJ		172
DSAL		129
DSEG		
DSOC	32	147
DSTP	5	21
ELWU		2
HBFU	7	30
HBOF	45	48
JCUF	138	53
JMZL	49	37
JPNT		21
KGWB	39	125
KPH7	12	42
KSLR	36	51
LICR	5	41
NNBN		484
PZAF	20	45
S6CY	117	163
WPCS	39	71
WYS3261		67
3EOD	35	115
3FYC	15	12
9LUB	22	188
9MTT	15	14
9VWY	42	72
MAUREE	8	
MELLON WMEC 717	1	
METEOR T-AGO 9	6	
MILROSS	6	34
MING HOPE	4	17
MOBIL ARCTIC	15	36
MOBILFUEL	34	112
MONTPELIER VICTORY	16	58
MORMACRACE	25	66
MORMACSABA	2	
MORMACSUN	23	69
MOZART FESTIVAL	18	
NANCY LYKES	38	72
NEPTUNE LEO	16	33
NEW YORK MARU	9	20
NOPAL BRANCO	37	84
NORSE PILOT	75	135
NORWAY	19	
OCEAN DUKE	2	
OCEANOGRAPHER	45	178
OGDEN WABASH		4
OLGA TOPIC	17	109
ORE MERIDIAN	26	31
ORIENTAL COMMANDER	17	62
ORIENTAL EXPORTER	18	20
ORIENTAL MERCHANT	37	85
OTTO N. MILLER	26	18
OVERSEAS JUNEAU	22	
PACBARONESS	11	9
PACIFIC ACE	15	85
PACIFIC PEACE	12	34
PACIFIC VENTURE	76	178
PACMAJESTY	8	11
PACPRINCE	4	4
PAN PACIFIC	31	39
PATUCA	1	
PERSIAN REEFER	73	149
PINK SKY	2	
PIONEER CRUSADER	3	30
PRESIDENT ADAMS	33	14
PRESIDENT HARRISON	8	72
PRESIDENT JOHNSON	66	167
PRESIDENT PIERCE	62	132
PRESIDENT TRUMAN	64	135
PRINCE OF TOKYO	23	
PURE OIL	14	109
R G FOLLIS	18	29
RELIANCE WMEC 615	1	41
REVERE	72	107
RIO ABAUCAN	5	2
ROBERT E LEE	14	27
ROSE CITY	13	36
S P LEE	40	83
SAM RATULANGIE	15	
SAN MARCOS	46	78
SANTA BARBARA	19	45
SANTA MARIANA	17	69
SCILLA	48	119
SEALAND CONSUMER	48	111
SEALAND GALLOWAY	38	106
SEALAND PIONEER	24	49
SEALAND VENTURE	26	98
SEATRAIN LEXINGTON	62	117
SEATRAIN YORKTOWN	39	101
SERAFIN TOPIC	12	29
SHIRLEY LYKES	3	31
SILVER LADY	36	43
SIMBA	10	42
SKAUGRAN	42	91
SNOWFLAKE	37	87
SONIC INTREPID	27	85
SPAIN MARU	23	15
STAR DIEPPE	11	
STELLA LYKES	13	71
STOVE TRADER	12	106
SUGAR ISLANDER	29	78
SWEETBRIER WLB 405	19	
TAKARA	8	
TARA	1	
TEXACO MONTANA		131
TFL DEMOCRACY	24	68
THOMPSON LYKES	13	
TOMBEI MARU	18	17
TOSCA	1	
TOYOTA MARU 83	118	41
TRANSCOLUMBIA	3	120
TSU	22	
ULTRASEA	2	19
UNITED SPIRIT	16	48
VALOR	3	
VANGUARD	19	
VIENNA WOODS	14	25
WALTER RICE	14	102
WESER EXPRESS	52	110
WESTWIND WAGB 281	18	
WINTER STAR	10	19
WORLD HERCULES		11
YELLOWSTONE	1	
YUKON T-AO 152	48	49
ZOELLA LYKES	46	103
4BA4		55
6ZWP	6	10
8SB2	15	39
8SA4	18	103
8WCB		46
ELXT	29	143
HPLE		3
HRLB	11	116
JHAQ	27	26
JMJB	22	21
JNSA	12	14
KWBF	79	152
KPAL	6	15
KTSD		12
LIGH	54	95
NBBL	3	3
SBAM		9
VPFA	15	32
WDZB	13	19
WDL8190		12
XEXC	19	34
3LEFX		10
6MDS	13	11
8NBF	59	52
9WPV	33	170

SUMMARY: GRAND TOTAL VIA RADIO 24434 GRAND TOTAL VIA MAIL 48632

Rough Log, North Atlantic Weather

August and September 1980

ROUGH LOG, AUGUST 1980--There were major differences between the climatic storm tracks and the actual tracks this month. The primary track was from the Great Lakes, across the Maritime provinces, and then eastward toward the United Kingdom. Over the eastern ocean the track was more diffuse, spreading from the English Channel to Iceland. There were many storms over northeastern Canada, but they were west of their usual location. Only one penetrated the Labrador Sea as it raced southeastward. The usual track crosses northern Quebec into Baffin Bay. There was a secondary track northward out of the United Kingdom.

With the differences in the storm tracks it is only logical to expect the sea-level pressure pattern to differ from climatology. There were two 1008-mb low centers, one about 500 mi southeast of Kap Farvel and the other 600 mi east-southeast of Kap Farvel. The normal shows two 1008-mb centers, one over Cape Chidley and the other 1008-mb center slightly south of Iceland. There were multiple high centers, averaging 1015 mb, surrounding Greenland. The Azores High at 1023 mb was normal but southwest of its usual location. Pressure over the eastern United States was near normal, but it was higher than normal over western Europe. Low pressure centered near the North Pole was lower than usual at 1001 mb.

The primary anomaly center was minus 6 mb near 47°N, 37°W. The low pressure over the North Pole produced a minus 11-mb circular anomaly. The Labrador Sea and Baffin Bay were covered by a positive 6-mb anomaly, while western Europe supported a positive 3-mb center.

The upper air pattern was quite different from climatology. The LOW over the North Pole was 138 m lower than normal. The long-wave trough from this LOW was shifted from 65°W longitude to 30°W longitude. South of latitude 60°N the trough line extended southwestward paralleling the East Coast about 300 mi off the coast rather than over it.

There were two tropical cyclones this month--hurricanes Bonnie and Charley. Although hurricane Allen formed the last day of July, all its violence and destruction occurred this month.

Extratropical Cyclones--The principal cyclones this month were tropical. There was an average number of extratropical cyclones, some fairly large in size, but not especially strong.

While hurricane Allen was swirling through the Caribbean, this storm formed over northern Maine on the 4th. At 0000 on the 6th it was over Cape Race. There were thunderstorms in the warm sector that day. The WVFM found 35-kn gales from the northwest on the 7th as did a Soviet ship at 47°N, 36°W, near the occlusion. By 1800 the storm had moved east of the GENERAL JASINSKI (44°N, 45°W) bringing northwesterly winds of 48 kn. At 0000 on the 9th OWS Lima measured 35-kn southeasterly winds with 13-ft waves. By 0600 another LOW between Greenland and Iceland absorbed this center.

This LOW was first analyzed over the southeastern shore of Lake Superior on the 8th. It raced eastward and was over the Gulf of St. Lawrence on the 10th. The FALCON was near 40°N, 58°W, with 37-kn winds and 15-ft seas. At 1200 on the 11th the LOW was 988 mb centered near 51°N, 45°W (fig. 36). The ITALICA (38°N, 48°W) was slightly south of the cold front with 48-kn winds. The SEA-LAND GALLOWAY at 44°N, 48°W, was some distance north of the front with 20-ft seas. On the 13th at 0000 the QUEEN ELIZABETH 2 was in the southeast quadrant sailing into the storm with 35-kn winds. West of the center OWS Charlie measured 35-kn winds from due north with 15-ft seas.

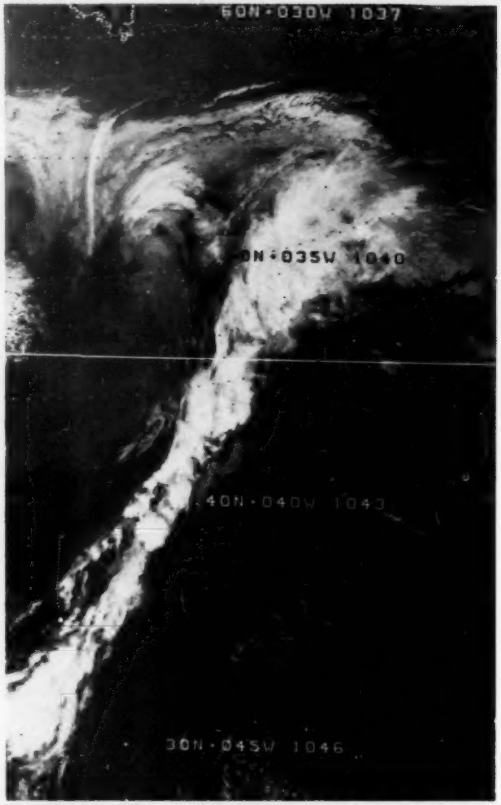


Figure 36.--The cloud pattern resembles a giant "7." Although the satellite precisely locates the storm, it takes ship reports to accurately describe the weather.

On the 14th the LOW suddenly turned northward, and a second LOW broke off and remained stationary for a few hours. The SEATRAIN CHARLESTON was

sailing westward with 50-kn winds from the north and 13-ft waves pounding her beam. The storm moved over Iceland and was lost over the Greenland Sea.

Lake Erie generated this storm. By 1200 on the 12th the 1004-mb LOW was over Nova Scotia. The British ship GBPW near 39°N, 63°W, found the winds to be 51 kn from the southeast. A Swedish ship was north of the warm front at 1800 on the 13th with 40-kn winds from the east. On the 15th the LOW moved under strong zonal upper air flow and raced eastward. At 1200 the LOW was analyzed as 988 mb, and the DART EUROPE (48°N, 30°W) was only yards from the center with a pressure of 989.6 mb and 50-kn winds from the west (fig. 37). At midday on the 16th the STAR BULFORD (51°N, 19°W) was about 200 mi south of the 992-mb LOW with 40-kn winds and 16-ft waves. On the 17th the FEDERAL RHINE (52°N, 15°W) and the NAET (60°N, 00°W) both had 40-kn gales. The storm was traveling northward over the Norwegian Sea on the 18th.

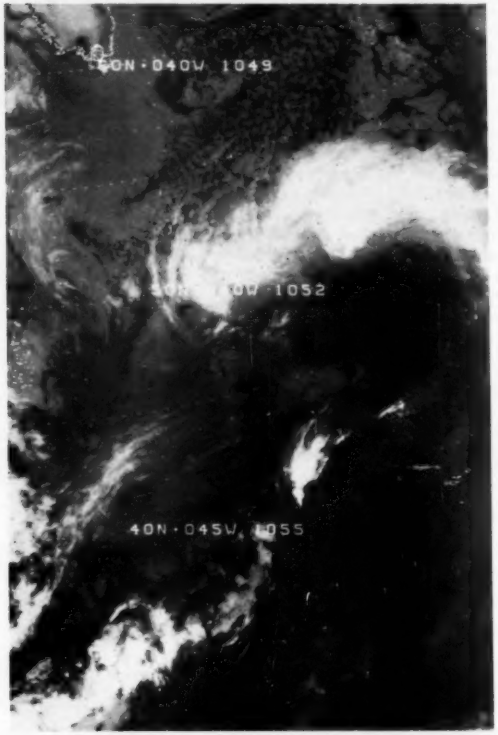


Figure 37.--The DART EUROPE appears to be under clear skies, even though she was very close to the LOW's center.

South-central Canada was the birthplace of this storm. It moved north of the Great Lakes on the 14th. The storm was over Cape Breton Island at 997 mb at 1200 on the 16th. Several ships near the Maritime provinces had gales.

On the 17th there were many reports from ships with gales southeast of Newfoundland. The ORCO MINER (46°N, 42°W) north of the associated warm front had 45-kn southeasterly winds with 23-ft seas. At 0000 on the 18th the storm was tightly wound around a 976-mb center near 52°N, 48°W. Charlie measured 41-kn winds out of the southeast and 15-ft seas. At 1200 the BARETTE JACOB (50°N, 45°W) radioed a report of 48-kn southwesterly winds with 23-ft seas. The SEA-LAND MARKET was not far away at 1800 with 40-kn winds. On the 19th Charlie had 20-ft seas, but before nightfall the LOW had died and another had formed near Iceland. Hurricane Bonnie was approaching from the south.

As the storm above turned northward on the 18th, a small LOW formed in the trough. The SEA-LAND GALLOWAY was northwest of the 1002-mb center with 35-kn northerly winds and 20-ft waves. She was following the storm, and 24 hr later had 40-kn winds from the northeast with 26-ft seas and 38-ft swells. At this time hurricane Bonnie was northeast of the LOW near 46°N, 40°W (fig. 38). The high swell waves were probably attributable to Bonnie. This storm was turning northward on the 19th.

Figure 38.--Hurricane Bonnie, a tropical storm at 46°N, 39°W, is farther north than the extratropical LOW near 40°N, 50°W.

There were two reports of 50-kn winds at 1200 on the 20th--the ATLANTIC COGNAC (44°N, 46°W) and the THAMESFIELD (41°N, 52°W). The AMERICAN ARGOSY was at 45°N, 50°W, with 45-kn winds and 20-ft waves.

As the storm traveled northward it also curved westward and weakened. On the 21st the LOW stalled near 52°N, 48°W, and hovered around that position until the 24th, when it was absorbed by approaching tropical storm Charley.

This storm blossomed in 12 hr between Kap Farvel and Iceland on the 19th. At 1200 the MANCHESTER CONCORDE was 400 mi south of Keflavik with 43-kn winds and 18-ft waves. On the 20th the storm was felt on the North Sea. Many ships and platforms had gales with the RIGG (60°N, 09°W) calling the seas 25 ft. At 0000 on the 21st the LOW crossed the Norwegian coast at 976 mb (fig. 39). The winds picked up as they gathered up a northerly component. There were several reports near 50 kn with the waves as high as 26 ft. This was a large LOW. It was centered over the Gulf of Finland on the 22d. High winds were still blowing over the North Sea. The Danish station Thyboron measured 45-kn winds. The highest waves were 23 ft. On the 23d the LOW was over northern Russia, and the winds returned to a more reasonable speed over the North Sea.

Figure 39.--The cloud pattern of the deep storm has been disrupted by its passage over the mountains, but the northerly winds are apparent over the Norwegian Sea.

This was not much of a LOW until tropical storm Charley started feeding warm moist air into the circulation. The LOW formed northeast of Charley on the 24th. On the 25th it turned to a northward track. Late in the day the SEA-LAND CONSUMER found gales. At 0000 on the 26th the 980-mb LOW was 180 mi south of OWS Charlie. He had 35-kn winds and 18-ft seas. Tropical storm Charley was about 450 mi to the south. A drilling ship over the Grand Banks had 35-kn winds. The ITALICA was south of Charley with 50-kn winds. By 1200 Charley was extratropical. At 1800 the SKULPTOR VUCHETICH had only 37-kn winds near 43°N, 24°W, but the swells were 26 ft. The ZINNIA (52°N, 42°W) had 47 kn on the 27th. The storm weakened on the 28th.

Tropical Cyclones--Hurricane Bonnie lived and died far out in the North Atlantic. Her northerly track took her from west of the Cape Verde Islands to southeast of Greenland as she flirted with the 40th meridian for more than 2,000 mi. Bonnie developed from a large area of disturbed weather. The first indication of her existence came from the RUDDBANK and from satellite photographs on the 14th. Bonnie intensified as she started her northward journey. By the morning of the 15th, some 1,200 mi southwest of the Azores, she reached hurricane intensity with a well-developed eye. Bonnie peaked on the 16th when winds near her center climbed to 75 kn. She was moving northward at about 12 kn. Later in the day winds dropped to minimal hurricane strength. She maintained this intensity for the next several days, as she passed 450 mi west of the Azores. By the 19th Bonnie was moving over the colder waters of the North Atlantic. She was also rapidly accelerating, reaching forward speeds of up to 45 kn toward the north-northeast.

Hurricane Charley had his roots in a persistent extratropical low-pressure system off the U.S. East Coast. The LOW gradually acquired the structure of a tropical cyclone. By the 23d, some 550 mi east of Norfolk, winds near his center were estimated at 70 kn (fig. 40). After meandering aimlessly for a time Charley began moving eastward. Maximum winds remained at 70 kn, while gales extended out 150 mi to the north of the center and 50 mi to the south. Gradually Charley's forward speed increased to about 17 kn.

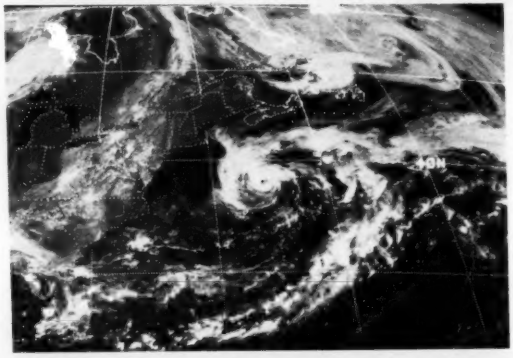


Figure 40.--Hurricane Charley, east of Cape May, is headed for a rendezvous with the extratropical LOW south of Kap Farvel.

By the 24th Air Force reconnaissance and satellite pictures showed a weakening, and Charley was downgraded to tropical-storm strength. Early on the 25th Charley raced across the 50th meridian at about 40 kn. Later in the day he was absorbed into a large low-pressure system.

Casualties--The Cypriot ARTEMIS encountered heavy weather in the eastern Mediterranean on the 4th and water leaked into the engineroom. Crew abandoned ship to the PRIMAVERA I, which towed the ARTEMIS

to Port Said. The 344-ton Liberian LOFA struck a submerged object in heavy weather and poor visibility off Monrovia. The vessel was beached at Buchanan. The 86,098-ton British NORDIC CRUSADER sustained heavy-weather damage on the 6th. The West German WESTERDIEK grounded in fog on the 8th off Loviisa.

The Polish KOPALNIA MYSLOWICE and the 10,250-ton Brazilian CALANDRINI collided in fog off Amsterdam on the 17th. What was described as a rogue wave swept a 13-yr-old boy who drowned off the excursion boat OREGON INLET QUEEN at Oregon Inlet on the 21st. A series of waves knocked down other passengers on the foredeck. The LAKE ALMANOR suffered damage from heavy swell at Hampton Roads on the 24th during bunkering. The yacht JOLLY ROGER was dismasted on the 30th off Margate, England. The 836-ton Panamanian ferry IVA suffered heavy-weather damage this month. The American GULF BANKER had rough sea damage to deck cargo.

Other Casualties--The U.S. Navy cruiser ST. LOUIS renamed the Brazilian ALMIRANTE sank off the Cape of Good Hope while being towed to breakers in Taiwan.

ROUGH LOG, SEPTEMBER 1980--This was a busy month for extratropical cyclones across the North Atlantic between latitudes 45° and 55°N in the west to latitudes 55° to 65°N in the east. Over North America the storms were farther north than normal. There were storm tracks from north of Lake Winnipeg to the Davis Strait; eastward over the northern Great Lakes to Nova Scotia then towards Ireland; and another from Labrador toward the Faeroe Islands. Only one storm traveled up the U.S. East Coast (in the last week of the month), where there is normally a primary track.

The sea-level pressure pattern was a close match with climatology, but pressure centers were more intense. The 1000-mb Icelandic Low was near 60°N, 27°W, about 150 mi southeast of its 1005-mb climatic counterpart. The Bermuda-Azores High was 1026 mb near 37°N, 32°W, 5 mb higher and 200 mi north of its 1021-mb climatic mate. A tongue of high pressure 4 mb higher than normal stretched across southern Europe to the Black Sea. The pressure over the eastern United States was from near normal to plus 2 mb east of Cape Hatteras.

There were two major pressure anomaly centers. A minus 6 mb was centered near 59°N, 27°W, and a plus 5 mb was centered near 40°N, 24°W. In general the pressure over Europe ranged from 3 mb over normal over Italy to 5 mb over Finland.

As usual the upper air flow was near zonal between 40°N and 55°N latitude. The usual 700-mb trough over Baffin Bay and the Labrador Sea was split into two troughs, one over the Foxe Basin and the other about 35°W longitude. The trough off Portugal and North Africa was deeper and sharper than usual.

September is usually the month with the most tropical cyclones, and this month was normal. There were five, two tropical storms and three hurricanes. They were Danielle, Earl, Frances, Georges, and Hermine.

Extratropical Cyclones--A quick summary of the month indicates the Bermuda-Azores High well established along latitude 35°N with the cyclone track between latitude 50° and 60°N. The second week the High moved eastward over the Azores with the cyclones continuing along 55°N. During the third week the High spread eastward from the Azores into Europe. The cyclones over the western ocean shifted southward as far as latitude 45°N. A significant HIGH moved out of Canada and over the western waters. The fourth week the high pressure was back to normal along 30° to 35°N, and the major LOWs were near latitude 60°N.

This first significant storm of the month developed south of James Bay late on the 1st. It deepened as it moved over the Gulf of St. Lawrence on the 3d, and the first gales were reported. A Bahamian vessel in Cabot Strait radioed a report of 52-kn winds. The stern trawler MARIA TEIXEIRA VILARINHO was blown aground at 53°27'N, 55°46'W (fig. 41). The crew was rescued by the TAVERNER. The vessel had almost 1 million pounds of fish aboard. Apparently, the vessel lifted anchors to move offshore but lost power and was blown onto rocks at about 0600 on the 4th. Efforts to free the vessel failed and she was abandoned.

At 1200 on the 4th the 980-mb storm was near 53°N, 50°W. The SIR ROBERT BOND at 50°N, 55°W, had 45-

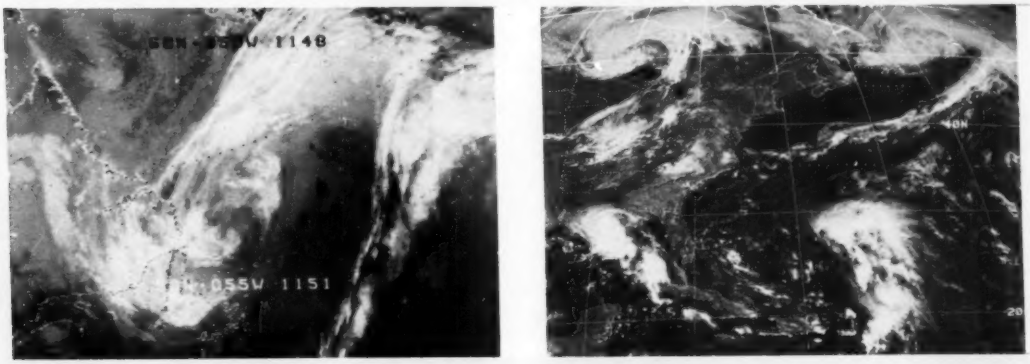


Figure 41.--The onshore winds that grounded the MARIA TEIXEIRA VILARINHO are graphically portrayed in the clouds west of the storm but not their force. The right image is infrared at 1151, a polar-orbiting satellite; the left image is visual at 1700 from a geostationary satellite. Danielle is forming off the coast of Louisiana on the geostationary image.

kn northwesterly gales. Later the MANCHESTER RENOWN west of the center had 44-kn winds, 23-ft seas, and 30-ft swells. On the 5th a ship near 47°N, 49°W, had 48 kn, and the GULF SHIPPER (49°N, 42°W) had 45-kn winds with 13-ft seas. On the 6th the waves increased to 23 ft. The C.V. STAGHOUND had 35-kn gales and 20-ft waves near 50°N, 32°W. Late on the 6th, another center developed to the northeast of the first one. There were a few gale reports on the 7th, and the VULCANUS in the North Sea had 47-kn southerly winds. By the 8th the original LOW had disintegrated.

This was the extratropical version of hurricane Georges. At 1200 on the 8th he was listed as a 75-kn hurricane, but 12 hr later the cold environment had transformed the storm into a 992-mb extratropical LOW near 50°N, 43°W. The storm passed north of OWS Charlie at 1200 with 40-kn winds and 21-ft seas. The GENERAL JASINSKI at 55°N, 30°W, was due east of the storm with 48-kn southerly winds. On the 10th the CAST TERN (48°N, 28°W) found the winds to be 50 kn. The FALCON (54°N, 24°W) had 44-kn winds and 20-ft seas. OWS Lima reported 25-ft swell waves. Late on the 10th the storm passed over the North Sea with gales. It continued moving inland.

The next storm was also the remains of a hurricane--Earl. Earl was still considered a tropical storm as he crossed 51°N, 25°W, at 0000 on the 11th while embedded in an extratropical cyclone. By 1200 the two cyclones had merged. Three ships, none of which were listed in the July 1980 edition of AMVER ships, reported winds of over 50 kn. Lima measured 44-kn winds and 15-ft waves. On the 12th the 972-mb storm was over Pentland Firth. Gales up to 45 kn and waves up to 20 ft were found mainly over the North Sea. The SHETLAND SHORE (56°N, 02°E) had 50-kn winds and 25-ft waves at 1800. The number and speed of the gale observations decreased as the storm moved over Scandinavia.

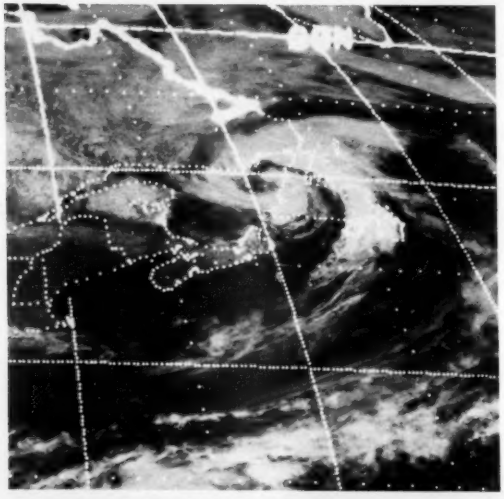


Figure 42.--The relatively small storm was over the Strait of Belle Isle at 1700.

This storm can be traced to the eastern slopes of the Canadian Rocky Mountains on the 6th. It traced a sinusoidal curve across Canada with a negative slope as it plunged from Hudson Bay to the Gulf of St. Lawrence. At 1200 on the 12th the storm was 994 mb east of Anticosti Island (fig. 42). Gales were reported over Cabot Strait. SEDCO measured 38 kn on the 13th. An American ship had 40 kn on the 14th near 47°N, 49°W. By 1200 on the 15th the storm was 978 mb near 57°N, 27°W. OWS Charlie measured 41-kn winds and 20-ft seas. The circulation was as far north as Iceland and bringing winds over 40 kn to the fishing fleet. The ZINNIA and DORDRECHT were south of the center with winds of 40 kn and waves up to 25 ft. The LOW was weakening on the 17th, but it managed to survive until it was over Nordkapp on the 18th.

Monster of the Month--This was another long-lived storm that tracked nearly one-third of the way around the world. It was born on the high plains of Montana on the 11th. It traced a nearly straight rhumb-line track along 45°N, passing over the Great Lakes on the 13th and 14th (fig. 43) and reaching Nova Scotia on the 15th. The storm intensified as it crossed the Grand Banks. At 1200 on the 16th it was 992 mb near 48°N,

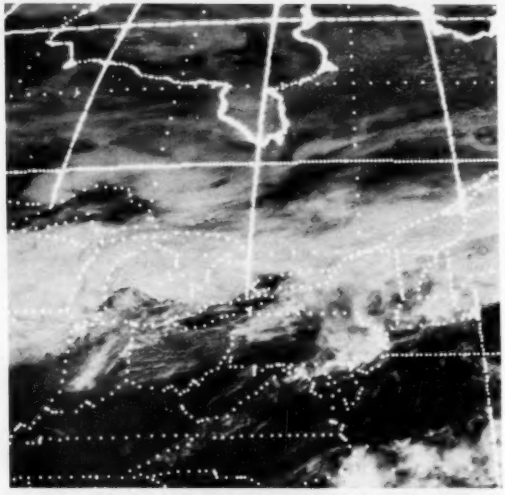


Figure 43.--At 1700 on the 14th the diffuse storm was centered over Lake Ontario, but it is not apparent on this individual image.

Figure 44.--Two vicious storms. The high-level circulation (white) from hurricane Frances feeds northeastward, helping to fuel this strong extratropical storm.

46°W. The ATLANTIC CONVEYOR had sailed through the cold front a few hours earlier and now had 45-kn westerly winds with 25-ft waves on her bow. The storm was 972 mb at 1200 on the 17th (fig. 44). Several ships had winds near 50 kn and waves up to 20 ft. The AMERICAN LEADER had only 40-kn winds near 48°N, 35°W, but the waves were 30 ft. The DORDRECHT now near 54°N, 31°W, suffered 60-kn winds and 23-ft waves. At 1800 two ships, including the ZINNIA, had 60-kn winds and 38-ft waves. The TURANDOT found 36-ft waves.

Twenty-four hours later at 1200 on the 18th the 972-mb storm was near 54°N, 15°W. Many ships had bridge-shaking winds and waves (fig. 45). The ARMADALE was the hardest hit with 49-ft waves and 55-kn winds near 48°N, 21°W. Other ships with winds over 50 kn and/or waves over 30 ft were the CINULIA, C.P. VOYAGEUR, DART CANADA, and SEATRAIN SARATOGA. OWS Romeo had 26-ft seas. On the 19th the SEATRAIN SARATOGA (49°N, 19°W) had 46-ft waves near the ARMADALE, which still had 49-ft waves. Romeo and a ship were calling the waves 26 ft.

The storm had started curving southward on the 19th and the pressure began rising. At 0600 on the 20th an

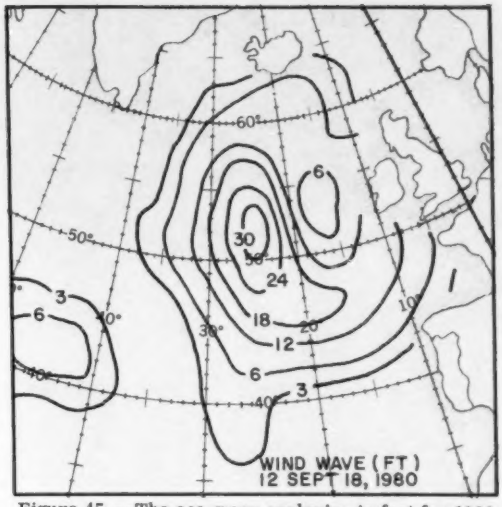


Figure 45.--The sea-wave analysis, in feet for 1200 September 18, generated by the storm.

area of great instability must have passed Romeo as she reported 64-kn northerly winds with 26-ft seas. The storm moved to near La Coruna on the 21st, then it started back-tracking and was absorbed by the next storm.

This frontal wave formed very near the weather station on Sable Island on the 19th. Hurricane Frances was to the east. On the 20th the wave passed very near SEDCO, which measured 40-kn winds and 16-ft seas. On the 21st Frances was a small tropical storm embedded in the extratropical circulation. There were many gale and high-wave reports this day. Frances was absorbed by 1200. The GETAFIX was in the southwest quadrant about 300 mi from the center where quite often some of the worst weather occurs. She had 70-kn winds at 1200 with no waves reported and 63 kn with 33-ft swell waves at 1500. Charlie measured 50-kn winds and 26-ft waves.

As the 22d dawned the LOW was moving northward. The CARCHESTER (49°N, 29°W) was sailing westward at less than 5 kn and had been having 30- to 40-ft waves for over 6 hr. The ARMADALE and Charlie were still having 28- to 33-ft waves. By 0000 on the 23d the CARCHESTER was encountering only 23-ft waves at 49°N, 31°W. The LOW was now 972 mb about 200 mi east of Kap Farvel. The storm was filling rapidly and shrinking.

This storm had a rather complicated origin. A storm center moved south of Hudson Bay on the 22d. That day a ship believed to be the KEEWATIN was near Churchill on Hudson Bay and reported 44-kn bone-chilling northerly winds. The ship was sailing out of the Bay and the winds dropped to 37 kn on the 24th as the LOW moved northeastward. This storm moved over Baffin Island, and two other LOWs formed at the point of occlusion and over the Labrador Sea on the 25th. Several ships had gales over the Labrador Sea.

A Netherlands ship off Hopedale radioed that they

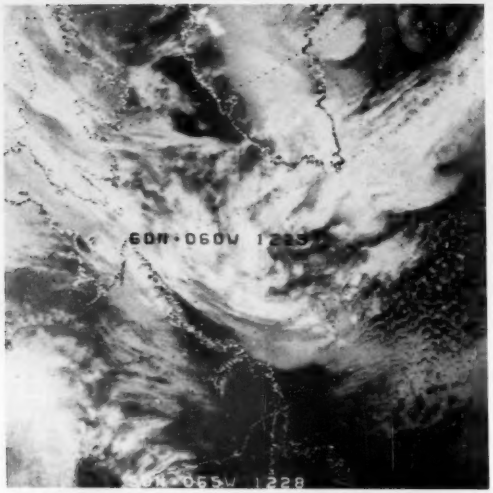


Figure 46.--The low-pressure center is just getting organized over the Labrador Sea.

were having 65-kn winds and 20-ft waves on the 25th (fig. 46). An American ship nearby had 43 kn with 16-ft seas. By 1200 on the 26th the LOW that formed at the occlusion was 978 mb near 60°N, 30°W, and the center of attention. There were quite a few gale reports, and OWS Charlie measured 45-kn winds with 25-ft seas. On the 27th the ARCTIC was near Kap Farvel with 58-kn winds. LIMA reported only 35 kn just prior to passage of a trough line. On the 28th the storm was northeast of Iceland and headed for the Arctic.

The Great Lakes nursed this storm. It formed over Wisconsin and fed off the warm water of the Lakes. By 0000 on the 27th it was over the northern border of Maine. The NOVO MESTO (40°N, 61°W) and SEDCO (47°N, 49°W) both had 50-kn winds. On the 28th the 980-mb storm was approaching the Denmark Strait. The BORRUYSK (57°N, 22°W) had 37-kn winds but 30-ft seas, while OWS Lima at longitude 2°E had 42-kn winds and 18-ft seas. The storm moved over Iceland on the 29th. In the southerly flow, the SMIT LLOYD 9 and the GTOT both had 50-kn winds near the Orkney Islands. OWS Mike measured 42-kn winds, while Lima had 20-ft seas. Gales were still blowing as the storm moved into the Barents Sea.

This storm came out of Labrador. It was over the Labrador Sea on the 29th at 1005 mb. Some Canadian ships were reporting gales. By 1200 on the 30th the storm was 986 mb west of Kap Farvel, and the front was well past Charlie, leaving 45-kn winds and 20-ft seas. At 1800 the swells were 25 ft. Lima reported 50-kn winds. At 0600 on October 1 the winds hit 58 kn and the waves 36 ft. At 1200 there were many reports over 40 kn generally east of longitude 20°W. On the 1st and 2d the ship listing was saturated with gale or higher reports over the North Sea. The VULCANUS appeared to take the high-wind award with 68 kn at 54°N, 04°E. The ABBEY (59°N, 20°W) had the highest waves of 39 ft. By the 3d the storm was over the Gulf of Bothnia and much subdued.

Tropical Cyclones--An early flurry of activity began on the 4th when tropical storm Danielle sprang to life as a depression about 100 mi south of the southeast Louisiana coast (fig. 41). Early the following morning a jack-up barge, the STAR 2, working on a Chevron rig 17 mi southwest of Grand Isle, capsized. Six crewmen reached the fixed platform, while three others were rescued by nearby vessels; one crewman was missing. While it was not immediately apparent whether the weather caused the capsizing, it certainly hampered the rescue efforts.

Later that same morning (5th) Danielle was christened a tropical storm while moving westward just off the Louisiana coast. Winds near the center were estimated at 50 kn, while nearby offshore oil rigs were encountering 30- to 40-kn winds. That evening the broad, diffuse center moved ashore near Sabine Pass close to the Texas-Louisiana border. Tides along the Louisiana coast were estimated at 3 to 5 ft above normal. The weakening system spread heavy rains and thunderstorms to the north of her path. By the 6th 12 to 17 in of rain had fallen in the Beaumont-Port Arthur area; Lakeview measured 17.04 in. A couple of tornadoes were also reported along with local flash flooding. There have been no reports of casualties, except for the missing barge crewman.

While Danielle was penetrating Texas, hurricanes Earl and Frances were coming to life out near the Cape Verde Islands. Earl followed a path similar to Bonnie's in August as he flirted with the 40th meridian on a meandering northward journey. Earl reached tropical-storm strength some 700 mi northwest of the Cape Verde Islands on the 6th. He attained hurricane status some 3 days later as he approached the 40th parallel near 41°W. Maximum winds were estimated at 70 kn on the 9th. By this time Earl was ingesting cooler air and accelerating northeastward. The following day he crossed 50°N and was turning extratropical; winds, however, were still running at 65 kn near his center.

Frances was spotted just south of the Cape Verde Islands, on the 6th, as a tropical storm. By the 8th, after tracking westward, she reached hurricane strength. Frances maintained this intensity until the 20th as she traveled a parabolic course that took her as far west as about 51°W between 27°N to 29°N. On the 9th winds climbed to 100 kn; this was the estimated maximum. From the 11th through the 15th Frances maintained an 80-kn maximum as she moved first west-northwestward, then gradually turned northward. On the 16th and 17th her winds climbed back to about 85 kn, and Frances was now heading toward the north-northeast. Several ships got involved with Frances. On the 16th the MORMACWAVE was east of the center with 40-kn winds. A Polish ship was northeast of the storm with 58-kn winds, which increased to 85 kn at 1200. The storm caught up with the NORDPOL as she sailed northeastward. She had over hurricane-force winds for over 30 hr. Her lowest synoptic time pressure was 985 mb at 0000 on the 17th with 44-ft waves. At 1200 the SHOZEN MARU had 49-ft waves (fig. 47). The NORDPOL had turned southward and then westward to escape the storm. Frances was moving northward again on the 19th generating 75-kn winds about

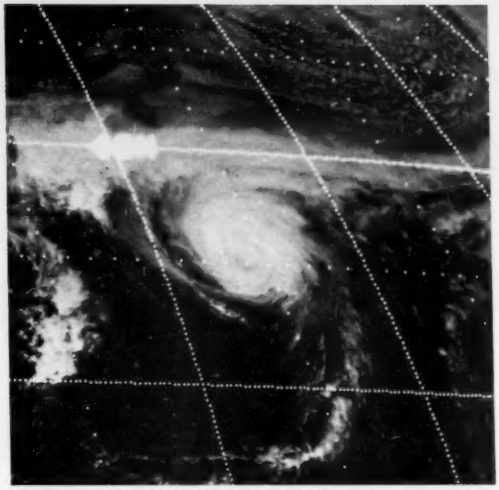


Figure 47.--A different view of hurricane Frances on the 17th from 22,000 mi. (Also see fig. 44.)

Figure 48.--About to be hurricane Georges.

450 mi southeast of Cape Race, Newfoundland. Within 60 mi of the storm's center the BISCAYNE STAR from the Mediterranean for New York lost her steering. With her rudder jammed, she was at the mercy of Frances. In addition damage to the hatch cover caused flooding in the No. 1 hold, and the vessel was listing about 30° to 40° to starboard. The BISCAYNE STAR was encountering 65-kn winds in 20-ft seas. Several vessels arrived to help, including the GLOBE EXPRESS and the DAWSON. In addition a Canadian Air Force plane flew over. The vessel was able to pump the water and was not in immediate danger.

By the 20th Frances, accelerating northeastward, had dropped to tropical-storm strength and was losing her tropical characteristics.

Hurricane Georges had a brief fling in the northern North Atlantic before turning extratropical. Georges was first detected as a tropical depression late on the 5th some 475 mi southeast of Cape Hatteras. Moving toward the north-northeast, the storm posed little threat to the United States. However, he did send swells pounding along the East Coast. On the 7th Air Force reconnaissance reports and satellite photos showed that a new center had developed, and the system had rapidly strengthened--some 425 mi south of Halifax, Nova Scotia. The storm was christened Georges. Winds of 45 kn were blowing around a 997-mb center, which was heading rapidly northeastward (fig. 48). Before the day was through, Georges reached hurricane strength some 440 mi southwest of Cape Race. Maximum winds were estimated at 75 kn as gales extended 200 mi in the southeastern semicircle and 150 mi to the northeast. Forward speed was accelerating to 35 kn as Georges began to turn extratropical on the 8th.

On the 20th tropical storm Hermine began as a depression in the western Caribbean about 175 mi east of Cape Gracias, Nicaragua. Moving westward, the depression skimmed the northern coast of Honduras. At noon (EDT) on the 21st Hermine was christened a tropical storm. Maximum winds climbed to near 50 kn as the storm crossed the Gulf of Honduras and headed for Belize. Winds reached 60 kn as Hermine moved inland, on the 22d, about 40 mi north of Belize City. Central pressure was 994 mb, and tides were running 3 to 5 ft above normal. Hermine maintained her identity as she moved across the Yucatan Peninsula and into the Bay of Campeche. By the afternoon of the 23d, about 100 mi east-northeast of Vera Cruz, Mexico, Air Force reconnaissance measured a central pressure of 995 mb with maximum sustained winds of 55 kn. Hermine was heading west-northwestward at about 12 kn. However, by the 24th, Hermine had stalled about 140 mi east of Vera Cruz. Strong winds and prolonged heavy rains battered the Mexican coast around the Bay of Campeche. By the 25th the center had drifted inland just less than 100 mi southeast of Vera Cruz. Winds up to 45 kn pounded the area. Rains continued to produce flooding as the storm slowly dissipated.

Casualties--There were three collisions involving six vessels in fog over the Kiel Canal and Helsingborg on the 5th. The URSULA and CAROLA, the ATKARSK and MERAN, and GABBRO and SZCZECIN TRADER were involved. All damage was light. The CLYMENE rescued a yachtsman from the 50-ft yacht JEANTEX about 700 mi northeast of St. John's, Newfoundland, on the 16th. A Canadian Armed Forces aircraft spotted the man with signals from an emergency locator transmitter. There were more fog and collisions on the Kiel Canal on the 23d and 24th. They involved the ZUIDWAL with the KONIN and the ENRICO BERLINGIERI with the LADOGA. These vessels reported heavy damage. The CUPID arrived Montreal on the 29th with wet sugar from hatch leakage during heavy weather.

Other Casualties--The AGIOS IOANNIS broke mooring cables and suffered other damage during heavy swell on the 6th at Sepetiba, Argentina.

Rough Log, North Pacific Weather

August and September 1980

OUGH LOG, AUGUST 1980--There were fewer extratropical cyclones this month than normal. They followed climatology only in the largest sense. Those that survived to clash with the larger-than-life Pacific High were forced into a northeasterly course. The primary track--if there was one--originated in the vicinity of 40°N, 170°E, and traced northeastward in the Gulf of Alaska. Another track could be said to originate east of Mys. Lopatka and end over Bristol Bay.

The mean sea-level pressure pattern reflects the average storm tracks. Without a doubt, the major feature was the 1032-mb Pacific High, 8 mb higher than normal, near its normal 40°N, 150°W, position. There was also a 1018-mb abnormal HIGH over the Sea of Okhotsk. The 1012-mb Aleutian Low was 4 mb higher than its climatological counterpart and over the Seward Peninsula, rather than south of Mys. Navarin.

The ocean north of 40°N and west of longitude 170°W, and north of 27°N and east of 170°W, had above-normal sea-level pressures. The negative area to the south had a maximum of minus 3 mb. There was a deep LOW over the North Pole, which produced a minus 11-mb anomaly over the Arctic Ocean.

In the upper air the subequatorial High was higher than normal. A trough extended southward from the Polar Low over the Bering Strait. The strong HIGH accented the ridge west of the North American coast and the trough over the coastal mountains. One of the more salient features was a deep trough east of the Asian coast. There is normally a weak trough in this area, but higher-than-normal heights inland of the coast greatly accented the west side of the trough.

This was a light month for tropical cyclones, with only four in the North Pacific. Over the eastern ocean there were hurricanes Isis and Javier and over the western ocean typhoons Marge and Norris.

Extratropical Cyclones--The first storm was the extratropical continuation of typhoon Lex. By 1200 on the 7th he had converted to extratropical near 38°N latitude. At that time a Japanese ship was sailing westward across the top of the LOW with gales out of the east and 20-ft waves. At 2100 the HOHKOKUSAN MARU was west of the center with 48-kn northerly winds, 23-ft waves, and a barometric pressure of 987 mb. At 0000 on the 8th the OCEAN VENUS (42°N, 156°E) had 43-kn winds with 12-ft seas. The LOW turned northward on the 8th, and at 1200 the HOHKOKUSAN MARU was in the southwest quadrant with 20-ft waves. On the 9th the LOW was 992 mb near 47°N, 156°E. The NEW GOLDEN PHOENIX was 10° longitude to the east with 52-kn winds.

On the 10th at 1200 the SAKHALINSKIE GORY was near the cold front with 43-kn winds. At this time the LOW suddenly turned eastward to dissipate near the Pribilof Islands on the 13th.

Monster of the Month--This was the extratropical continuation of typhoon Marge. By 1200 on the 16th Marge had incorporated a frontal system into her circulation and was extratropical. The OCEAN ROSE (43°N,179°E) was very near the center of the storm on the east side

with a barometer reading of 988.5 mb. The winds were 43 kn from the southeast with 16-ft waves. She was sailing eastward and tried to cross north of the fast-moving storm. This was like trying to beat a train at a railroad crossing. By 0000 on the 17th the storm

Figure 49.--The polar-orbiting NOAA satellite sensed this infrared image at 2037 on the 16th.

had plunged northeastward to 50°N, 175°W, at 986 mb (fig. 49). The PACIFIC VENTURE was in the warm sector with 45-kn southerly winds. At 0600 the CRESSIDA (49°N, 171°W) reported 35-kn winds and 20-ft waves. At the same time the NOAA ship SURVEYOR near 55°N, 165°W, had 39-kn southeasterly winds. Reports were sparse at 1200, but at 1800 the TONE MARU (52°N, 164°W) had 44-kn winds from 240° with 23-ft waves. Another ship nearby had 40 kn. In the Alaska fishing fleet the SEA SOUNDER near Unimak Island reported 65 kn with gusts to 80 kn and 30- to 35-ft swells. The LESLIE FOSS north of Port Moller reported 55 kn with gusts to 100 kn and 25- to 35-ft waves.

At 0000 on the 18th there were 12 ships in the storm that reported winds of 35 kn or greater. The NISSHIN MARU No. 2 had the highest of 50 kn near 56°N, 167°W, and the JUPITER No. 1 (55°N, 159°W) had the highest waves with 33-ft swells. The storm was over land on the 19th and weakening, but the DAVIDSON and the SPRAY CAP in the vicinity of 55°N, 154°W, both had 54-kn winds. The storm disappeared from the charts late on the 20th.

This storm formed extratropical as a frontal wave over the Yellow Sea on the 15th. At 0600 on the 17th the TOYOTA MARU No. 10 was east of Tokyo with 35-kn gales and 16-ft waves north of the center. No gale reports made the weather circuits on the 18th, but on the 19th the MERCY and the NISSAN MARU near 40°N, 168°E, had winds of 40 kn. By 0000 on the 20th the storm was 995 mb near 43°N, 177°E. There were isolated gale reports with one of 42 kn at 1800. On the 21st the gale reports picked up. The PRESIDENT TYLER (44°N, 180°) had 42-kn northerly winds, and the PRESIDENT CLEVELAND (50°N, 175°W) had northeasterly 62-kn winds. The storm was pushing against the stubborn 1032-mb Pacific High. Several ships had gales on the 22d. As the storm moved over the top of the HIGH on the 25th, it weakened and almost was lost over the mountains on the 26th, but it survived to continue across Canada.

This potential storm came out of China and was over the Yellow Sea on the 30th. The BPPX (34°N, 123°E) radioed a report of 47-kn winds north of the center. By September 1 the storm was near 38°N, 149°E. The PRESIDENT ADAMS was northeast of the center with 45-kn winds and 20-ft waves. The storm was increasing in size, but not especially in strength. By 0000 on the 3d it was 994 mb near 41°N, 168°E. The SEATRAIN INDEPENDENCE (45°N, 172°E) located 36-kn winds.

As an aside, the USNS S.P. LEE was north of Point Hope, Alaska, at 71°N, 170°W, with below-freezing 35-kn winds and 20-ft waves. There was a 984-mb LOW over the Arctic Ocean near 82°N, 180°. At 1800 on the 3d the NORTH STAR III was near the Arctic Circle at 66.8°N, 163°W, with 40-kn winds blowing into Kotzebue Sound driving 16-ft waves.

On the 4th several ships had gales, and the HIRA MARU (46°N, 163°W) had northeasterly 48-kn winds. The storm disappeared on the 6th.

Tropical Cyclones, Western Pacific--Typhoon Marge developed on the 8th about 300 mi northwest of Eniwetok. Moving northward along the 155th meridian for most of her life, Marge attained typhoon strength late

Figure 50.--The eye of typhoon Marge is slightly south of Marcus Island at this time on the 10th.

on the 9th. By the 11th, as Marge passed about 70 mi east of Marcus Island, winds reached a peak of 110 kn (fig. 50). She continued to generate typhoon-force winds well into the 14th after recurving toward the east-northeast. The following day Marge, at tropical-storm strength, began to turn extratropical as she moved into higher latitudes.

Typhoon Norris popped up in the Philippine Sea on the 24th. He headed west-northwestward and reached tropical-storm strength on the 25th as he crossed the 20th parallel near 132°E. Heading for Taiwan, Norris attained typhoon strength on the 26th, about 300 mi east-southeast of Taipei (fig. 51). Maximum winds

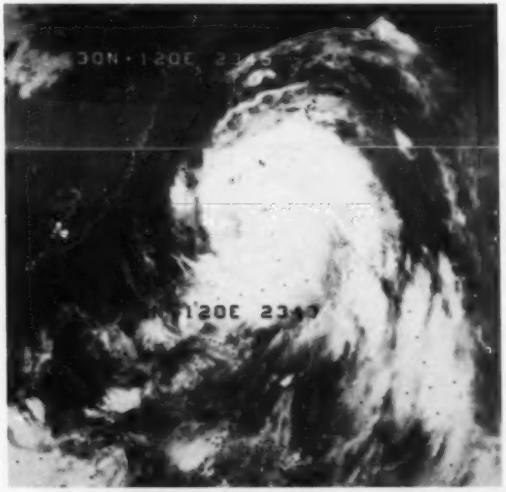


Figure 51.--Typhoon Norris looks like a carbon copy of Marge, only farther east at the same latitude.

climbed to 85 kn before Norris swept across northern Taiwan. Heavy rains triggered floods that were responsible for two deaths and destroyed 60 houses. Four fishing vessels also sank off the east coast. However, the torrential rains eased the island's worst drought in 30 yr. Norris crossed the Formosa Strait, moved inland over mainland China near Fu-chou, and dissipated.

Tropical Cyclones, Eastern Pacific--Hurricane Isis began life on the 6th about 180 mi southwest of Acapulco. Paralleling the Mexican coast, she reached hurricane strength on the 7th. By the 8th Isis was generating winds of 75 kn near her center, which was now some 180 mi west-southwest of Manzanillo (fig. 52). Hurricane Isis retained this title until the 10th, when she was demoted to a tropical storm. The following day near 22°N, 117°W, Isis fell to depression strength.

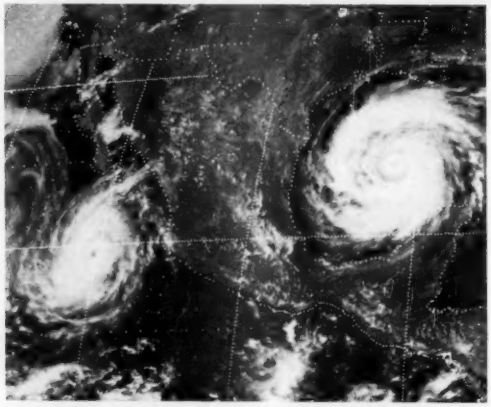


Figure 52.--At 1700 on the 8th two hurricanes straddled Mexico, Isis off the west coast and Allen off the east coast.

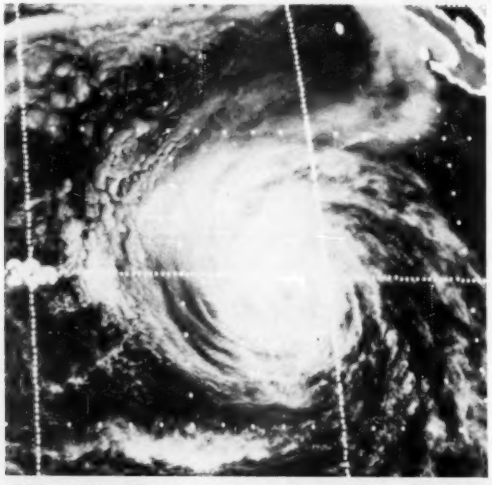


Figure 53.--Hurricane Javier was still a violent storm late on the 26th.

Hurricane Javier flickered briefly toward the end of the month. Forming about 300 mi west of Isis' birthplace, Javier intensified rapidly on the 23d to reach hurricane strength the following day. He moved west-northwestward. Winds near his center climbed to 100 kn on the 25th shortly before he crossed the 115th meridian near 17°N (fig. 53). This, however, was Javier's peak. He gradually diminished. By the 27th near 20°N, 122°W, he was downgraded to a tropical storm. The following day this brief flame was snuffed out.

Casualties--The 86,098-ton British NORDIC CRUSADER on a voyage from Seven Islands to Kure had heavy-weather damage on the 6th. The 15,674-ton Liberian SNOW WHITE was surveyed at Kaohsiung in drydock for heavy-weather damage on the 8th. The 983-ton HOSEI MARU and another 997-ton Japanese tanker collided off northern Japan in fog on the 21st. About 1,700 gal of heavy oil was spilled.

Other Casualties--The British IRON SOMERSBY was at Port Kembla with heavy-weather damage. The BANGLAR JOY diverted to Mormugao due to shifting cargo in heavy weather late in the month. The American GULF BANKER was at Dar Es Salaam on the 20th with weather damage to deck cargo.

ROUGH LOG, SEPTEMBER 1980--The storm traffic south of Alaska to latitude 40°N and east of longitude 180° was very heavy this month. The western ocean traffic was light except for tropical storms. Another area of dense storm traffic was from Manchuria across the southeast corner of the U.S.S.R. Two of these storms penetrated as far east as 180°. Only two storms came out of the primary climatic area of cyclogenesis off Japan. The storms south of Alaska had no preferred orientation. Climatology shows the primary storm track stretching from Honshu to the Gulf of Alaska, with a second primary track paralleling the first one about 600 mi to the south from 180° eastward.

In general the sea-level pressure over the North Pacific was near normal to slightly higher with the latter more prevalent. There were two 1008-mb centers of the Aleutian Low versus a climatic normal of 1006 mb. One center was near the climatic location over Bristol Bay. The other was north of Umnak Island. The Pacific High was 1023 mb near 37°N, 145°W, about 300 mi north of its normal 1021-mb location. There were two 1018-mb bulges in the western extension of the Pacific High. There was also a 1009-mb LOW over the northern tip of Sakhalin Island.

The largest anomaly was plus 6 mb west of the Bering Strait. There was also a plus 4-mb area southeast of Mys Lopatka and a plus 3-mb area west of Vancouver Island. The largest negative anomaly was minus 2 mb near 46°N, 170°W.

There were three long-wave troughs at 700 mb that influenced the North Pacific weather. One was inland of the Asiatic coast. The next was eastward over the central ocean out of a low-pressure center over the Pribilof Islands, and the third was off the California coast. The usual ridge over the Canadian Rocky Mountains was less accentuated than normal.

There were six tropical cyclones over the western ocean and two over the eastern ocean. They were typhoons Orchid, Percy, Sperry, Vernon, and tropical storms Ruth and Thelma in the western ocean, while

the eastern ocean hosted tropical storm Lester and hurricane Kay.

Extratropical Cyclones--The first 10 days of the month were relatively quiet. Early in the first week the Pacific High was near 35°N, 150°W, with multiple pressure centers over the northern ocean. The Pacific High gradually moved westward to the central ocean by the end of the week. By the end of the second week the Pacific High was back off the North American coast centered off Portland, Oreg. During the middle of the month the ocean was again separated into multiple centers, including several tropical LOWs. During the third week the Pacific High had a second center over midocean. In the last week of the month a large cyclone developed over the Gulf of Alaska with a weak High over the central ocean.

The first significant storm did not develop until the 11th. It was the result of the consolidation of three weak LOWs. The first gale report was by the PRESIDENT TRUMAN (39°N, 180°) at 0000. By 1200 the single 990-mb center was at 50°N, 173°W. The ALASKA MARU was northeast of the rapidly deepening center at 1800 with a pressure of 987 mb and easterly winds of 45 kn (fig. 54). At 0000 on the 12th the NOAA ship DISCOVERER was near 54°N, 164°W, about 650 mi east-northeast of the 976-mb center with 40-kn winds from the east and 18-ft seas. A ship far to the south near 36°N, reported 30-ft swell waves. At 0600 the USCGC MUNROE was near Saint George Island with 53-kn winds from the east and 21-ft seas. By 1200 the storm had dropped to a central pressure of 966 mb as it crossed the Aleutians near Sequam Island. On the 13th the MIYAJIMA MARU at 57°N, 177°E, was contending with 44-kn winds from the north and 20-ft waves. A ship near 53°N, 175°E, reported 33-ft swell waves. The ALL ALASKA was near the Shumagin Islands with 50-kn southerly winds as reported to WBH-29 at Kodiak. On the 14th the CAPTAIN HOOK reported 45- to 50-kn winds from the south in Halibut Bay. The LOW was now filling and wandering over the Bering Sea.

Figure 54.--This looks like a deep winter storm rather than an early fall one.

On the 15th and 16th the Pacific High was near 50°N, 145°W, at 1037 mb. There was weak low pressure near 34°N, 135°W. The pressure gradient was tighter closer to the high-pressure center than the low-pressure center. Several ships including the GOLDEN GATE BRIDGE, PRESIDENT MADISON, and PRINCE RUPERT CITY in the area of 40° to 45°N and 135° to 145°W reported gales up to 46 kn and swell waves up to 23 ft.

This LOW moved northward as a wave along a front west of the Pacific High. At 0000 on the 18th it was near Yakutat, Alaska, when it started deepening. At 1800 the PORTLAND was west of Port Alice with 40-kn winds. On the 19th several ships had winds up to 40 kn, including the GREAT LAND off Queen Charlotte Sound (fig. 55). Another ship in the same area had 20-ft waves. The sea-wave analysis for the 19th and 20th showed an area centered near 50°N, 140°W, with 15-ft waves. At 0000 on the 20th the TONE MARU (50°N, 132°W) had 38-kn winds, 20-ft seas, and 28-ft swells. Later in the day the LOW was destroyed by the mountains.

This storm system was a combination of many LOWs.

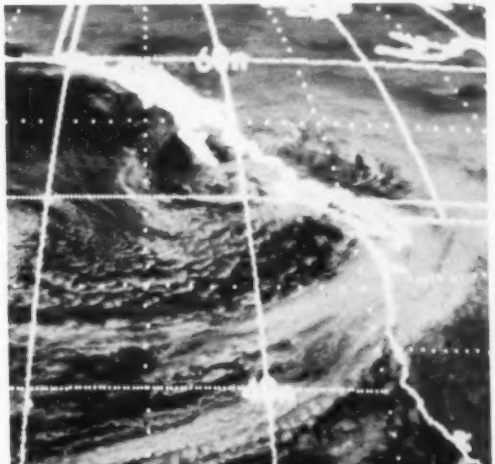


Figure 55.--The storm was centered in Queen Charlotte Sound at this time (2045).

What appeared to be the originating LOW formed as a wave on a north-south front west of the Pacific High. The wave moved northward and the HIGH weakened. At 1800 on the 25th the PRESIDENT VAN BUREN (47°N, 169°W) southwest of the center had 48-kn winds. At 0000 on the 26th the storm was near 54°N, 161°W. That day there were several 40-kn wind reports.

At 0000 on the 27th the LOW was 960 mb northwest of Port Moller. Another strong LOW was racing eastward along 50°N, from the Sea of Okhotsk, into the circulation. There were two other small centers in the circulation, one to the south and another off the Oregon coast. There were many gale reports in this large circulation that stretched from British Columbia to Kamchatka and 70°N to 35°N. The ALASKA STANDARD at 59°N, 149°W, had 55-kn winds with 20-ft seas and 26-ft swells. A ship near the center of the Bering Sea had 30-ft waves. On the 28th the original LOW had curved westward, then southward, as the other LOWs traveled generally eastward (fig. 56). At 0600 OWS Papa had 51-kn winds from the southwest, and at 1200 the ARCO JUNEAU (50°N, 135°W) had the same speed from the southeast. She didn't report waves, but a ship nearby had 25-ft waves and another near 42°N, 149°W, had 30-ft waves.

On the 29th the LOW that had been to the south pushed northward along 145°W and became the primary LOW. At 0000 the WMCV (58°N, 144°W) found 60-kn easterly winds with 36-ft waves. The pressure was 971 mb (fig. 57). The SANKO STEEL (54°N, 143°W) had 33-ft waves. The EXXON SAN FRANCISCO (55°N, 139°W) had 45-kn

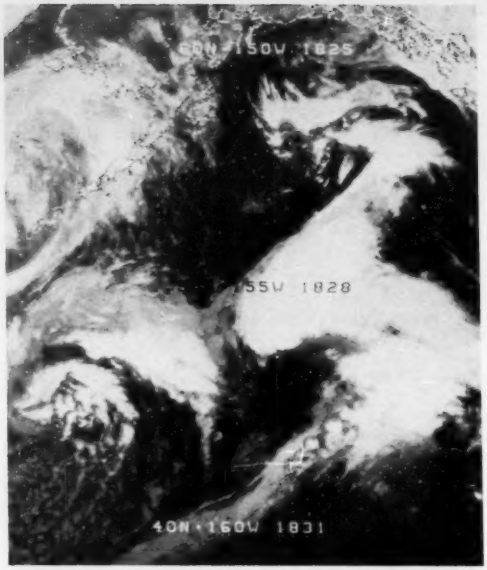
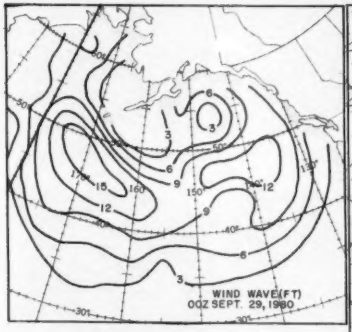
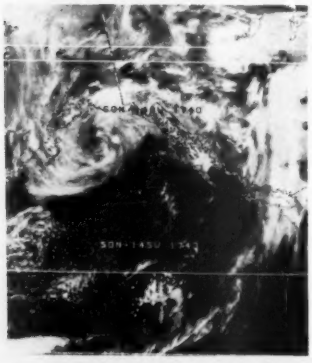


Figure 56.--This satellite pass caught all three low-pressure centers: 56°N, 168°W; 47°N, 167°W; and 48°N, 150°W.





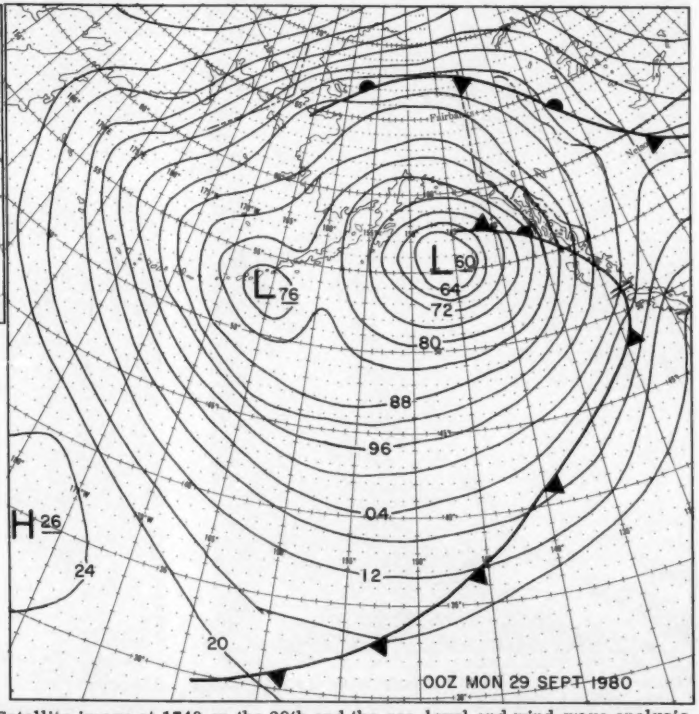


Figure 57.--Portrait of a storm. Satellite image at 1740 on the 29th and the sea-level and wind-wave analysis for 0000 on the 29th.

winds with 20-ft seas. The WRANGELL MARU at 55°N, 145°W, with a pressure of 948 mb, 38-kn winds from the south, and 26-ft swells, was within a few miles of the center of the LOW. There were many gale reports. By 1200 this LOW south of Valdez was the only one remaining in the circulation. It was still a large storm, but it was shrinking.

The WMCV was steaming southeastward very slowly. By 0000 on the 30th she was near 57°N, 142°W, and still had 25-ft waves, although the winds had dropped to 40 kn out of the south. At 1200 the PERENNIAL ACE at 52°N, 170°W, was far from the center of the storm (almost 800 mi) with mild 35-kn winds from 350°, but had 46-ft swells from 030°. The storm was rapidly deteriorating and by midday on October 1 was nearly gone, as another LOW raced into the Gulf of Alaska from the south. A severe extratropical Thelma was moving northeastward.

Tropical storm Thelma became extratropical on the last day of the month. The storm made the transition as it passed east and in front of the POLLENGER. The only difference to the ship was a shift in direction and an increase in windspeed. The waves ranged from 23 to 30 ft. At 1200 on the 30th her winds were about 20 kn, waves 23 ft, and pressure 982 mb, while about 200 mi northeast of the tropical storm. At 1800 they were 52 kn, 26 ft, and 976 mb about 100 mi from the center, and at 0000 on October 1, the winds were 45 kn, seas 30 ft, and pressure 998 mb, while about 200 mi south of the storm. At 0600 the winds were still 45 kn with 28-ft seas. The MOSEL EXPRESS was on a collision course with the storm at 0000 on the 1st with 60-kn winds. No one ventured out to look at the waves. The PACBARON was near 50°N, 165°E, at 0600 and also on a collision course into the storm with 65-kn easterly winds, 26-ft seas, and 49-ft southeasterly swells. At 1200 the BUNKO MARU (46°N, 167°E) was about 250 mi south of the storm with 52-kn winds and 30-ft waves.

On the 0000 chart of October 2 the LOW was 960 mb (fig. 58). A ship east of the center had 33-ft waves. The BUNKO MARU now had 60-kn winds, and another Japanese ship found 64 kn south of the center. At 0600 the EASTERN HIGHWAY (49°N, 174°E) encountered 60-kn winds and 33-ft waves, while the JLHP (49°N, 172°E) found 46-kn winds and 43-ft waves. The high swell waves at both ships continued through 1200. The storm was moving eastward along latitude 50°N and spreading its influence, while weakening the gradient.

On the 3d the SILVERFJORD (46°N, 174°W) called the winds 48 kn with 26-ft swells. At 1200 on the 3d the closest ship to the storm to radio a weather report that was plotted on the chart was the OHMINESAN MARU in the middle of the Bering Sea about 700 mi northwest of the center. Another ship that helped with the analysis was the PRESIDENT ADAMS at 32°N, about 1,100 mi to the south. At 0000 on the 4th there were the usual number of reports. The winds were now generally gales with some waves over 20 ft, but most were 10 to 15 ft. A ship in the easterly flow northeast of the center found 23-ft waves. On the 5th the LOW split into a double center.

Tropical Cyclones, Eastern Pacific--Hurricane Kay started life on the 15th as a tropical depression about 300 mi south of Acapulco. By the 17th Kay was a hurricane on a west-northwesterly track. Kay reached

Figure 58.--Late on October 1 the high-level moisture was north and east of the center. South of the center between 50°N and 40°N there were only low clouds (shades of grey).

her peak on the 19th when 115-kn winds were estimated near her center. The following day as Kay crossed the 120th meridian near 17°N, winds fell to 80 kn (fig. 59). By the 21st she was down to tropical-storm strength--down but not out. She recovered as she

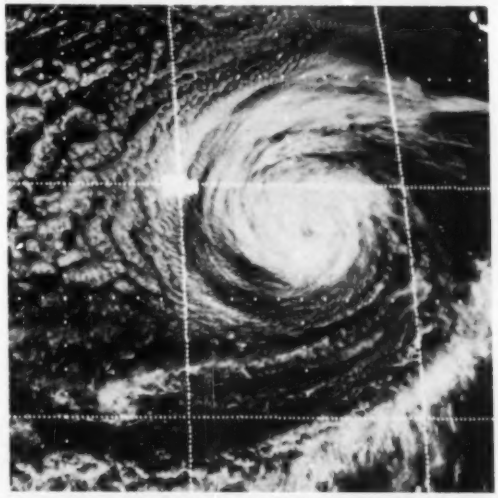


Figure 59.--Hurricane Kay lasted 9 more days before approaching Hawaii as a depression.

moved into central Pacific waters and was able to remain below 20°N. On the 22d she hovered near hurricane intensity, and by the 23d she found it--hurricane strength. Kay maintained hurricane force as she edged toward 20°N. On the 24th she was generating 80-kn winds just before crossing the 20th parallel near 139°W, then she began to weaken. On the 25th it was 75 kn, then 70 kn. The following day Kay, who had been travelling northwestward since the 24th, slowed and headed on a more westerly track. She clung tenaciously to that hurricane status until the 27th, near 23°N, 144°W. By the 29th Kay finally dropped to depression strength. She came within 200 mi of Honolulu, but was just a shadow of her former self. By the 30th she was heading northward and turning extratropical.

Tropical storm Lester was as brief as Kay was lengthy. He was first spotted about 120 mi south of Manzanillo on the 22d. Lester reached minimal tropical-storm strength the following day and retained it through the 24th. During the period he had wandered westward to about 110°W and stalled. By early on the 25th the stationary system was generating 25-kn maximum winds. Later that day the system dissipated.

Tropical Cyclones, Western Pacific--Typhoon Orchid developed in the waters north of Guam. On the 7th she was a tropical storm heading west-northwestward. By the following day, after crossing the 20th parallel near 136°E, she began the familiar parabolic swing northward. Orchid blossomed to typhoon strength on the 9th. In an area of heavy shipping she was causing problems. The OCEAN CONTAINER, under tow by the tug SALVADORE, broke her towline in the rough seas of Orchid just east of Shikoku, off Cape Shio. The BEAURIVAGE, laden with more than 240,000 tons of crude oil, touched bottom while standing off the coast of Japan during Orchid. She sustained minor damage.

The most tragic account was that of the DERBYSHIRE, which last reported on the 9th that she was holding due to heavy seas and the approach of typhoon Orchid. Later the typhoon passed right over this last-reported position (fig. 60). All but one of the DERBYSHIRE's 42 crewmembers were British; two officers' wives were also on board. The ship was enroute for Kawasaki with a cargo of 158,000 tons of iron ore concentrates from Seven Island, Canada. This is one of the biggest losses under the British flag.

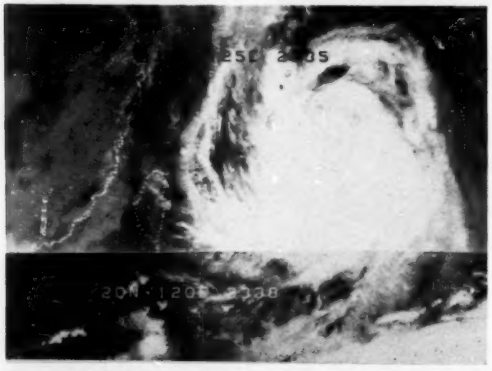


Figure 60.--Typhoon Orchid is churning the tranquil Pacific, reminding one and all of the tremendous energy contained in the atmosphere.

By the 10th maximum winds in Orchid had climbed to 80 kn as she made her way up the Ryukyus towards Kyushu. Even in port ships were having their problems. The SEA HAWK and HE TIAN collided while anchored at Mutsure, sinking the SEA HAWK. The master died, but all other crewmembers were rescued. The collision was caused by the HE TIAN apparently swinging in Orchid's gusty winds. The RYOJIN off Toba, the entrance to Ise Bay, dragged her anchor in rough seas and rammed the HYUNDAI, causing minor damage to both ships. Among the many ship reports the following had waves of 25 to 33 ft: CARDIGAN BAY, MITSUTAMA MARU, SEA-LAND TRADE, and TAKAYAMA MARU. The AMSTELMOLEN had 39-ft swells, the BARBER PERSEAS had 52-kn winds and 52-ft swells, and the NEDLLOYD STEENKERK battled 60-kn winds and 59-ft swells.

Orchid moved across Kyushu on the 11th and dropped to tropical-storm strength as she moved through the Sea of Japan. The storm resulted in six deaths. Torrential rains fell over Kyushu, Shikoku, and western Honshu; 15 to 23 in were recorded in several locations. Heavy rains also triggered landslides in Korea, resulting in another six deaths. About 110 fishermen were unaccounted for after high seas disabled 11 vessels. Orchid weakened and began to turn extratropical in the Sea of Japan.

Within the next few days there was an outbreak of depressions along the 18th parallel stretching from 150°E westward to 115°E. These systems were soon to develop into typhoon Ruth off Hainan, typhoon Percy in the northern Philippine Sea, and typhoon Sperry northeast of Saipan.

Ruth was the shortest lived of the three. Early on the 15th tropical storm Ruth crossed the Hainan coast about 40 mi southeast of Haikou, where a maximum gust of 62 kn and a minimum pressure of 992 mb were recorded. Ruth intensified as she moved across the Gulf of Tonkin. It is probable that she attained typhoon strength early on the 16th; a surface wind of 70 kn, at 2 a.m. LST, was reported at Bach Longvi, an island station about 45 mi from the center (fig. 61). Later, Ruth reached the Vietnam coast about 95 mi south of

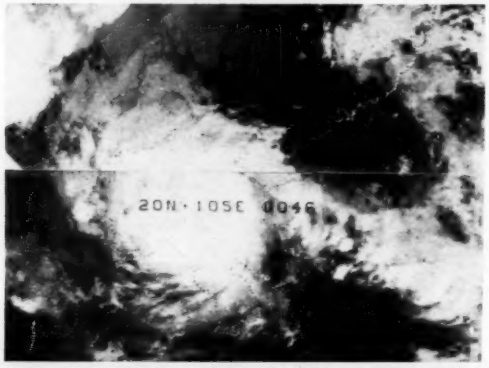


Figure 61.--Whether a tropical storm or a typhoon, Ruth dumped tremendous rains on Vietnam.

Hanoi. Winds were estimated at 75 kn around her 970-mb pressure center. According to the press, Ruth was the worst typhoon to hit Thanh Hoa province in 30 yr. At least 106 people died or are missing, while 500,000 were left homeless. A major rice-growing region was devastated, with the loss of about 2 million tons. Ruth dissipated over Lao late on the 16th.

Meanwhile, Percy had gained typhoon strength, on a slow northwestward course, about 400 mi northeast of Manila. Early on the 17th reconnaissance aircraft reported surface winds of 80 kn. Late in the evening Lan Yu Island off southeast Taiwan, some 90 mi from the center, reported a sustained wind of 99 kn from the north with gusts to 118 kn; this station is at an elevation of 1,065 ft. Percy peaked early on the 18th when surface winds were estimated at 125 kn (fig. 62).

Figure 62.--Typhoon Percy was roaring over Taiwan late on the 17th bringing death and devastation.

A few days earlier the GOLDEN PEAK had sent an S.O.S. that its main generator was out of order and the engineroom was flooded. The ship was in the Taiwan Strait close to Taiwan. The steering gear had failed initially. After drifting and then anchoring, the vessel started to drag towards Taichung. Both anchors gave way as Percy approached, and early on the 18th the GOLDEN EAGLE grounded hard near Taichung's rock causeway.

Percy crossed the southern tip of Taiwan early on the 18th, close to Hengchun, and caused serious damage. Nine people died, 400 homes collapsed or were destroyed, while banana and sugar cane plantations were devastated. During the afternoon the NEDLLOYD NAPIER, some 80 mi northwest of Percy's center, encountered 55-kn winds and a 994-mb pressure. Percy weakened and slowed as he headed for mainland China. Early on the 19th he crossed the coast about 50 mi northeast of Shantou. Once inland he dissipated rapidly.

Typhoon Sperry was already brewing far to the east as Percy crossed the China coast. Sperry was spotted on the 15th between Saipan and Marcus Island. Heading west-northwestward, Sperry intensified to tropical-storm strength that same day and started to recurve the following day. It wasn't until the 18th that he reached typhoon strength, at the same time Percy was ravaging Taiwan. The TAKAYAMA MARU found 33-ft swells. By now the typhoon was turning eastward. Late on the 19th after crossing the 145th meridian near 31°N, Sperry was downgraded to tropical-storm status. He soon became extratropical.

Tropical storm Thelma and typhoon Vernon came to life within 1 day of each other and about 900 mi apart. Thelma was detected on the 26th about 200 mi northwest of Saipan, while Vernon was found the same distance west-northwest of Eniwetok the following day. Both moved on a parabolic course, but Vernon was initially less decisive and trailed Thelma by several days. Thelma's northward movement past Iwo Jima on the 28th may have influenced the initial slow movement of Vernon. Thelma's winds reached a peak of about 55 kn on the 30th. The MITO MARU off Yokohama had 45-kn winds and 30-ft waves. By this time Thelma was across the 30th parallel and accelerating rapidly northeastward; she was also fast becoming extratropical. Vernon, meanwhile, had just become a typhoon and was still below 20°N. By the 1st Vernon's winds had climbed to more than 100 kn as he moved 200 mi west of Marcus Island. Vernon continued to intensify, reaching a peak of 110 kn the following day (fig. 63). Gusts were estimated at 135 kn with gales extending out 200 to 300 mi. Vernon was beginning to turn northeastward as he crossed 30°N near 149°E. The YAMAHIDE MARU (38°N, 153°E) had northeasterly 60-kn winds and 23-ft waves. He was also starting an extratropical transformation as cool air entered his circulation. However, Vernon's winds were still estimated at 50 kn with gusts to 65 kn when the last tropical warning was issued on the 3d.

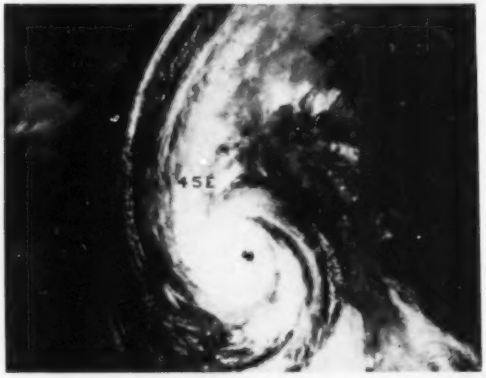


Figure 63.--Typhoon Vernon late on October 1. He was a true mariner and spent his life at sea.

Casualties--The Philippine wine tanker DONA SUSANA was aground in adverse seas and weather conditions at Kalatogan on the 13th. The 64,631-ton Liberian tanker was at Yokohama on the 16th with weather damage. The 6,334-ton BUM IL developed engine trouble from Busan to Los Angeles on the 27th. Heavy weather on the 29th resulted in an S.O.S. and the crew of 28 were rescued by the Japanese patrol vessel MIURA on October 2.

Other Casualties--The Greek EPIMENDIS was damaged by barges in heavy swell at a Peruvian port.

Marine Weather Diary

NORTH ATLANTIC, DECEMBER

WEATHER. The Icelandic Low decreases in pressure to less than 1000 mb and expands in area this month. It is centered near 60°N, 30°W. A second center, also less than 1000 mb, is centered near 69°N, 10°E. The Azores High is now 1023 mb southeast of the Azores near 35°N, 22°W. The north-south pressure gradient between the two centers has increased, resulting in higher mean windspeeds. The mean air temperature has decreased. The mean 0°C isotherm crosses the Labrador Sea from Kap Farvel to St. John's, then north to Iceland to Nordkapp. The maximum mean is 27°C in the Caribbean. Along the 40°N parallel the mean temperature ranges from 5°C off the New Jersey coast to 16°C northwest of the Azores and 14°C off Portugal. Only 1 percent of the observations fall below -12°C and above 0°C over Baffin Bay. South of 20°N only 1 percent are below 20°C and above 28°C. The 0°C sea-surface isotherm stretches from Sondre Stromfjord to Hamilton Inlet. The maximum mean sea-surface temperature reaches 28°C off Brazil and Liberia. Along 40°N the mean temperature ranges from 9°C off New Jersey to 15°C off Portugal with a bulge to 18°C at 40°W.

WINDS. The prevailing winds over the North Atlantic between 40°N and 60°N are from the western quadrant, except for the northerly winds off Portugal. South of 40°N the winds are generally east and northeasterly, except from the southeastern United States to the Azores where they remain westerly. The winds north of 60°N are fairly variable but do establish a general southerly component east of the 0° meridian and a northerly component west of 0°. Windspeeds average force 4 to 6 north of 40°N and force 3 to 5 south of 40°N. Winds over the Mediterranean Sea are predominantly from the northwest at force 3 to 5.

GALES. The occurrence of gales is now more frequent over middle and northern latitudes. Winds of force 8 or higher occur in 10 percent or more of the observations north of a line from the Bay of Biscay to some 500 mi off Cape Hatteras and east of its extension to the Davis Strait. Two areas in the Mediterranean Sea that report gale frequencies of 10 percent are located off the coast of Libya and an area extending nearly 200 mi southeastward across the Gulf of Lions. The area of maximum gale frequency, 20 percent or more, is found along a band some 800 to 1,000 mi wide, extending from southern Greenland to near 45°N, 40°W.

EXTRATROPICAL CYCLONES. The principal areas of cyclogenesis occur along the Gulf and East Coast of the United States; east of Newfoundland; the waters surrounding Iceland; and the Ligurian Sea and northern Adriatic Sea. The primary track leading from the Great Lakes crosses Nova Scotia then northward into the Davis Strait, with another primary track running from east of Nova Scotia to northwest Iceland and into the Norwegian Sea. Secondary storm tracks cross Hudson Bay, southern Sweden, the Mediterranean from Spain to Greece, and along the East Coast of the United States.

TROPICAL CYCLONES. Few tropical cyclones have been observed over the North Atlantic during December. Only seven tropical storms (force 8 or greater) have been reported for the period 1871 to 1980, of which three occurred in 1887. Of these seven storms, five reached hurricane force (64 kn or greater).

WAVE HEIGHTS. Wave heights of 12 ft or higher occur 10 percent or more of the time north of a line from southern Portugal to just east of Cape Hatteras except for the Davis Strait-Hudson Bay area. Frequencies of 10 percent are also observed in the Mediterranean Sea between Majorca and Sardinia and in the Caribbean Sea just off the north coast of Columbia. An elongated area extending from near 50°N, 25°W, to 62°N, 15°W, has wave heights of 12 ft or more 60 percent of the time and wave heights of 20 ft or more 15 percent of the time. The intermediate percentages fall between the 10- and 60-percent lines described above.

VISIBILITIES. Since November, the frequency of visibilities less than 2 mi has increased over the Labrador Sea with the rest of the North Atlantic not changing significantly. Areas with visibilities less than 2 mi in 10 percent or more of their observations include: the area from the Bay of Fundy to the west coast of Greenland; coastal areas of the North Sea, Baltic Sea, and Irish Sea; and, generally, latitudes north of Iceland.

NORTH PACIFIC, DECEMBER

WEATHER. The Aleutian Low has split into two 999-mb centers, one in the Gulf of Alaska about 150 mi southeast of Kodiak and the other about 100 mi north of the Rat Islands. The southern edge of cyclonic curvature extends to 35°N. The Pacific High at 1020 mb has retreated to 30°N, 135°W, off Baja California. The Asian High has intensified, increasing the pressure over the South China Sea and the Sea of Japan. The mean air temperature has dropped considerably, 8°C, to -24°C, over the Chukchi Sea. The freezing line extends from Bristol Bay to Hokkaido. The mean maximum is 28°C over the southwestern ocean. Along 40°N the mean temperature ranges from 1°C off Korea to 12°C off California. The temperature rarely rises above freezing over the northern Bering Sea. Over the Sea of Japan 98 percent of the temperatures are between -10°C and 12°C, while off California the range is 8°C to 18°C. The 0°C sea-surface isotherm parallels latitude 60°N. Along latitude 40°N the temperature ranges from 8°C in the Sea of Japan to 13°C off California. The 98-percent range is about 4°C on either side of the mean.

WINDS. Northeasterly winds prevail north of 58°N, averaging force 4 to 6; and south of 30°N, averaging force 3 to 5 except over the South China Sea where they average force 4 to 6. Off the California coast and from the Yellow Sea to the Kamchatka Peninsula northwesterly winds prevail, averaging force 3 to 4. Across the midlatitudes from the Kuril Islands to western Canada the predominant winds are westerly and average force 4 to 6.

GALES. The general area for winds of force 8 or greater has broadened this month. Most gales are observed between 30°N and 65°N. Ten percent or more of the observations between western Canada and the Kuril Islands and between 35°N and the Bering Sea show gale-force winds. Also, frequencies of 10 percent or more are observed in the Formosa Strait.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis extends from southern Japan to the northeast over most of the Kuril Island chain and southeast to near 35°N, 175°E. The westernmost primary track runs from the Sea of Japan across northern Japan to just east of the Kamchatka Peninsula. A second primary track runs from the center of the principal area of cyclogenesis northeastward south of the Aleutian chain and into the Gulf of Alaska. A third primary track stretches northeastward from near 40°N, 170°W, to near 50°N, 140°W, before swinging southeastward into the northwestern United States. Secondary tracks move east across the Bering Sea just south of Nunivak Island, southeastward along the Alexander Archipelago, and northeastward in a region between 40°N to 50°N and 130°W to 140°W.

TROPICAL CYCLONES. The number of tropical disturbances has decreased substantially since the warmer months. During 1949 through 1980 only one tropical cyclone occurred in the eastern North Pacific. It developed to the east of the Hawaiian Islands and reached hurricane strength ($\geq$ 64 kn). During an average 10-yr period in the western North Pacific one can expect 13 tropical cyclones of force 8 or greater of which 7 should reach typhoon status of force 12.

WAVE HEIGHTS. Wave heights of 12 ft or higher occur 10 percent or more of the time in most areas between Japan and North America. Frequencies increase to 30 percent between 38°N and the Aleutians and between the Kuril Islands and 133°W. Ten-percent frequencies also occur over the South China Sea. East China Sea, and Philippine Sea with frequencies of 20 percent occurring from Vietnam to the Formosa Strait.

VISIBILITIES. Since November the frequency of encountering visibilities of less than 2 mi has increased slightly north of 40°N. Frequencies of 10 percent or more are observed in the Sea of Japan, north of latitude 42°N across the western three quarters of the North Pacific, and scattered areas along the western coast of North America. Frequencies of 20 percent or more are encountered from northern Japan to the Bering Strait with frequencies of 30 percent, the highest reported, occurring between the Russian coast and St. Matthew Island.

NORTH ATLANTIC, JANUARY

WEATHER. The Icelandic Low is the dominant feature as far south as latitude 35°N. It is less than 997 mb, the lowest of any month, east of Kap Farvel. The Bermuda-Azores High is spilt into two centers along latitude 30°N, with a mean pressure of 1021 mb. The pressure gradient remains tight over the primary shipping lanes. The mean air temperature continues to cool. The 0°C isotherm runs south from Kap Farvel, over the Grand Banks, then southwest into Cape Cod. Over the Greenland Sea the 0°C isotherm approximates 70°N. The warmest mean temperature is slightly greater than 26°C south of latitude 10°N. The extreme air temperature ranges from -16°C over the Labrador Sea to 32°C near Trinidad. Along latitude 40°N the temperature ranges from 4°C off the United States to 14°C off Portugal. The sea-surface temperature changed very little except cooling north of the Gulf of Stream. The 0°C isotherm crosses Cabot Strait, then Cape Race to the Davis Strait, and then northeast from Kap Farvel through the Denmark Strait. Along latitude 40°N the sea-surface temperature ranges from 7°C off New Jersey to 15°C off Portugal.

WINDS. North of 30°N, the prevailing winds are from the southwest through northwest with the exception of an area just west and southwest of the Iberian Peninsula, where they are northerly. South of 30°N, the prevailing winds are from the east and northeast. Average windspeeds over the North Atlantic are predominantly force 4 to 6, except for an area extending 1,200 mi south and east of the southern tip of Greenland where the average force is 5 to 7. Winds over the Mediterranean Sea are mainly northwesterly with an average force of 3 to 4. Easterly winds are predominant over the Gulf of Mexico and Caribbean Sea with an average force of 3 to 4 over the Gulf and force 4 to 5 over the Caribbean.

GALES. Winds of Beaufort force 8 and higher are confined mainly to north of 30°N. Ten percent or more of the observations north of 35°N over the western Atlantic and north of 40°N over the eastern Atlantic report gale-force winds. The only area in the Mediterranean Sea with gale frequencies of more than 10 percent extends from the coast of France for some 150 to 200 mi southeast through the Gulf of Lions. The highest frequency of gales, over 30 percent, occurs south of Kap Farvel.

EXTRATROPICAL CYCLONES. During January Lows form most frequently along a band 150 to 250 mi wide stretching along the east coast of North America from the Carolinas to Nova Scotia. Other principal areas of cyclogenesis are along the Gulf Coast from Texas to Florida, east of Newfoundland, southwest of Iceland, the Gulf of Lions and Ligurian Sea, and the northern Adriatic Sea. Primary storm tracks extend across the Great Lakes from the Carolina capes to Newfoundland and toward Davis Strait. Another track is from the Gulf Coast to across the Grand Banks where the path splits toward the Denmark Strait and the Norwegian Sea. Secondary storm tracks extend from southern France to the northern Adriatic and from Corsica to southern Turkey. Other secondary storm tracks cross Scotland, the North Sea, and enter northeastern Europe.

TROPICAL CYCLONES. The occurrence of tropical cyclones during January in the North Atlantic is very rare. Only one tropical cyclone occurrence has been documented for the period 1871-1980. Its location was to the east of the Dominican Republic and between 10°N and 25°N.

WAVE HEIGHTS. Except for coastal areas and areas of concentrated ice, most of the North Atlantic, north of 25°N has wave heights of at least 12 ft, 10 percent

or more of the time. Frequencies of 10 percent or more also occur between the Balearic Islands and Sardinia and in the Caribbean Sea along the Columbia coast. A large area reporting frequencies greater than 50 percent lies north of 40°N and south of Iceland and between Newfoundland and Ireland with its northeast quadrant reaching a frequency of 60 percent.

VISIBILITY. The occurrence of visibility less than 2 mi is noted in more than 10 percent of the observations in an area north of a line extending from the southern edge of the Bay of Fundy, around the Grand Banks, then northeastward through Iceland, and connecting with the northern tip of Norway. The frequency increases to more than 20 percent in the area around the Strait of Belle Isle and over the Barents Sea.

NORTH PACIFIC, JANUARY

WEATHER. The Aleutian Low is the dominant feature extending from coast to coast and the Arctic Ocean to 30°N over the central ocean. The westward shift of the central pressure now has the 997-mb center east of the southern tip of Kamchatka at 170°E. The subtropical Pacific High extends from California to Hawaii with a mean central pressure slightly above 1020 mb. The Siberian High extends eastward over the East China Sea into the lower latitudes past 180°. The mean air temperatures over the midlatitudes continue to drop. The 0°C isotherm extends from Port Moeller to the Tsugaru Strait. The range is from -24°C over the Chukchi Sea to 28°C at the Equator between 125°E and 175°W. Between latitudes 30° and 60°N the temperature increases from west to east along a given latitude, except over the cold coastal current along the coast. At 40°N the mean air temperature ranges from -2°C off Korea to 12°C off California. At 40°N the range of temperatures is from -12°C near Korea to 16°C off California. The 0°C sea-surface temperature isoline bows northward from the Alaska Peninsula, then southwestward along Kamchatka through the La Perouse Strait. Along latitude 40°N the temperature ranges from 4°C in the Sea of Japan to 12°C off California.

WINDS. South of 25°N, the prevailing trade winds are from the east or northeast at an average Beaufort force of 3 to 5. The northeast monsoon is steady over Asiatic waters. Between 25°N and 50°N, the prevailing winds are from the northwest through southwest and average force 4 to 6. Winds north of 50°N, are predominantly out of the southeast across the Gulf of Alaska, east across the Bering Sea, and north across the Sea of Okhotsk. At these higher latitudes the winds average force 4 to 6.

GALES. Winds of Beaufort force 8 and higher are confined mainly between 30°N and 65°N and east of Japan and the Kamchatka Peninsula. A region with gale frequencies of 10 percent or more extends eastward to 148°W from southeastern Japan and northward to St. Paul Island. Most of the Aleutian chain reports frequencies of less than 10 percent, except for an area east of the Fox Islands to 157°W. The eastern half of the Gulf of Alaska also observes frequencies of 10 percent or more with the exception of the coastal areas. Gales associated with northers are encountered in the Gulf of Tehuantepec about 5 percent of the time.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis stretches from the Sea of Japan to 150°W along the 40°N parallel. Primary storm tracks run from the Sea of Japan across the main Japanese island to some 600 to 800 mi east, where one major track runs northward into the Bering Sea while a second one runs northeastward into the Gulf of Alaska. From the Gulf, storms move north into Alaska or west into Canada. Secondary storm tracks move out of Siberia into the Sea of Okhotsk where they join the major track to the Bering Sea.

TROPICAL CYCLONES. For the period in which we have fairly complete records (1949-1980) there hasn't been a reported tropical cyclone in the eastern North Pacific during January. The frequency, however, is greater in the western North Pacific, where for an average 10-yr period, four storms should reach tropical-storm strength ($\geq$ 34 kn) and three of these should reach typhoon strength ($\geq$ 64 kn).

WAVE HEIGHTS. Except for the protected coastal area, most areas between Hawaii and the Bering Sea, have wave heights of 12 ft or higher 10 percent or more of the time. Ten-percent frequencies are also observed in the South China Sea, East China Sea, and the Philippine Sea. Frequencies reach a high of 40 percent between the southern tip of the Kamchatka Peninsula and the Aleutians, where the waves are greater than 20 ft 10 percent of the time.

VISIBILITY. South of 40°N, the only areas where visibilities of less than 2 mi occur more than 10 percent of the time are in the Sea of Japan and a small area from Los Angeles to San Diego. North of 40°N, visibilities of less than 2 mi are reported 5 percent or more of the time with most areas north of 45°N reporting frequencies of 10 percent or more. Frequencies of 20 percent extend over the Sea of Okhotsk and much of the Bering Sea, with frequencies of 30 percent occurring along the eastern side of the Kamchatka Peninsula.

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